NOVA SCOTIA
Transportation and Public Works

Generic Environmental Protection Plan (EPP) for the Construction of 100 Series Highways

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RECORD OF REVISIONS

This Generic EPP is considered to be a 'living document' and updates will be prepared as new or revised information becomes available. Updates will be posted on the Department's website:

www.gov.ns.ca/tran/enviroservices/govEPP100.asp

It is the responsibility of all users of this Generic EPP to ensure they are using the most recent version. The following table has been included for your convenience.

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DEFINITIONS

Apron

A lining that protects a surface from erosion by dissipating the energy of a direct flow of water; it is placed on the downstream side of a velocity check or at the outlet of a culvert.

Berm

A constructed ridge that breaks the continuity of a slope.

Brush Mat

Matting composed of slash and non-merchantable wood placed on the ground to minimize soil disturbance by heavy equipment.

Buffer Zone

A strip of permanent vegetation that is not grubbed until the culvert for the drainage or watercourse has been installed. Typically the boundaries of the buffer zone are delineated with silt fence.

Erosion

Process by which the land's surface is worn away by erosive agents, principally water, wind, ice and gravity.

Erosion Control Blanket

A temporary ground cover, designed to keep seed bed in place until vegetation is established, by retaining soil moisture and protecting against the impact of raindrops. Can be made of jute, excelsior, wood or polypropylene.

Filter Bag

A geosynthetic bag which is used to filter sediment out of water. Water is pumped into the bag and allowed to flow out though the membrane, trapping the sediment in the bag.

Filter Fabric

A synthetic material of woven or non-woven (plastic) description. Its purpose is to allow water to filter through while retaining fine soil particles and prevent them from washing away.

Flow Check

A device installed across a drainage ditch to slow the velocity of concentrated flows, reducing erosion of the ditch and promote the deposition of suspended sediment. Can be made of sand bags or Clear Stone. Use only in small open channels.

Hydroseeding

Mechanical application, by spraying onto the surface of the soil, a specially mixed slurry of turf-establishing materials, consisting of water, seed, fertilizer, and short-fibre wood or paper mulch.

Mulch

A temporary natural or artificial layer covering the surface of soil to protect and enhance certain characteristics, such as retention of soil moisture and protection against the impact of raindrops.

Runoff

The portion of precipitation in a drainage area that is not absorbed into the ground but is discharged into streams (includes overland and open-channel flow).

Scouring

Erosion of the bed and banks of a channel, usually localized around an obstruction or structure in a channel or at the outlet of a pipe, due to an increase in water velocity around the obstruction or discharging from the conduit.

Sediment

Particles of soil that have become detached though erosion.

Sediment Barrier

A temporary perimeter control placed across or at the toe of a slope to intercept and detain sediment laden runoff, and to decrease sheet flow velocities as it leaves the construction site.

Settlement Ponds

A pond designed to intercept and detain sediment laden runoff from a drainage area for a long enough time that suspended solids may settle out.

Stabilization

The process of establishing an enduring soil cover of vegetation and/or mulch or other ground cover in combination with installing temporary or permanent structures for the purpose of minimizing soil erosion.

Swamp Mat

Mats constructed of 10x10 lumber used to place under tracks of heavy equipment to minimize ground disturbance and support equipment in wet areas. In some circumstances mats can be used as temporary bridges with DFO and NSEL approval.

Turbidity Curtain

A floating geotextile material which minimizes sediment transport from a disturbed area adjacent to or within a body of water. Provides sedimentation protection for a watercourse from up-slope land disturbance or from dredging or filling within the watercourse.

Turbidity (Turbid Water)

Condition of water when it becomes cloudy due to sediment moving in suspension in the water.

LIST OF ACRONYMS

CEAA	Canadian Environmental Assessment Act
CLC	Community Liaison Committee
CMP	Culvert Mitigation Plan *(prepared for various water crossings)*
DFO	Department of Fisheries and Oceans *(Federal)*
DNR	Nova Scotia Department of Natural Resources
EC	Environment Canada
ECM	Environmental Compliance Monitoring
ECP	Environmental Control Plan (prepared for various segments of the project)
EEM	Environmental Effects Monitoring
EPP	Environmental Protection Plan
ESC	Erosion and Sediment Control
NSEL	Nova Scotia Department of the Environment and Labour
ROW	Right-of-Way
TC	Transport Canada
TPW	Nova Scotia Department of Transportation and Public Works

FEDERAL/PROVINCIAL LEGISLATION AND GUIDELINES	RESPONSIBLE AGENCY
1.0 Federal Legislation	
- Canadian Environmental Assessment Act	- Environment Canada
- Canadian Environmental Protection Act	- Environment Canada
- Clean Air Act	- Environment Canada
- Species at Risk Act	- Environment Canada/Fisheries and Oceans Canada
- Fisheries Act - No Net Loss of Fish Habitat; Fish Passage; Disposal/Release of Deleterious Substances; Use of Explosives in Canada's Fisheries Waters	- Fisheries and Oceans Canada
- Migratory Birds Convention Act	- Environment Canada
- Navigable Waters Protection Act	- Canadian Coast Guard
- Transportation of Dangerous Goods Act	- Transport Canada
- Water Act	- Environment Canada
- Wildlife Act	- Environment Canada
1.1 Federal Guidelines	
- Environmental Guidelines and Design Criteria for Resource Road Construction	- Environment Canada
- Environmental Code of Good Practice for Highways and Railways	- Environment Canada
- Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities	- Environment Canada
2.0 Provincial Legislation	
- Environment Act	- NSEL
- Dangerous Goods Transportation Act	- TPW
- Special Places Protection Act	- Dept. of Education - Museum
- Occupational Health and Safety Act - Construction Safety Regulation General Blasting Regulations	- NSEL
- Sulphide Bearing Material Disposal Regulations	- NSEL
- Forest Act	- DNR
- Public Highways Act	- TPW
- Crown Lands Act	- DNR
- Ditches and Watercourses Act	- Municipal responsibility
- Endangered Species Act	- DNR
- Weed control Act	- Dept. of Agriculture and Fisheries
- Wildlife Act	- DNR
2.1 Provincial Guidelines	
- Standard Specifications	- TPW
- Approval Process for Pits Containing Slates	- TPW
- Asphalt Paving Plant Guidelines	- NSEL
- Erosion and Sedimentation Control Handbook for Construction Sites	- NSEL
- Guidelines for Environmental Noise Measurement and Assessment	- NSEL
- Guidelines for Sampling of Domestic Water Supplies in Conjunction with Construction of Highways	- NSEL
- Pits and Quarry Guidelines	- NSEL
- Policy Guidelines on Watercourse Alterations	- NSEL
- Procedure for Conducting a Pre-Blast Survey	- NSEL
- Watercourse Alteration Specifications	- NSEL
- Wetlands Directive	- NSEL

3.0 Joint Federal/Provincial Guidelines	
- Environmental Construction Practice Specifications	- Fisheries and Oceans Canada / NSEL
4.0 Other Guidelines	
- National Guide to Erosion and Sediment Control on Roadway Projects	- Transportation Association of Canada (TAC)

1.0 ENVIRONMENTAL PROTECTION PLAN

The Nova Scotia Department of Transportation and Public Works (TPW) is committed to the construction and maintenance of highways in a manner which is protective of the environment including maintaining water quality through erosion and sediment control, and minimizing disturbance to land use, wildlife and habitat. TPW has prepared this environmental protection plan (EPP) to communicate this commitment to TPW staff, Contractors, regulatory agencies and the public. This generic plan is intended for use on the construction of all 100 Series Highways and complements EPPs developed for individual projects and Environmental Control Plans (ECPs) for specific segments of a highway project.

1.1 TPW Environmental Policy

TPW implemented the following environmental policy in December 2000, which was endorsed by the Deputy Minister of the Department.

Rationale
The intent of this policy is to identify and resolve environmental issues when planning and implementing projects and programs undertaken by this department. Federal and Provincial environmental legislation provide the basis for environmental decisions; this department not only abides by the legislation, but strives to incorporate this environmental policy into all its decision-making processes.

Policy Statement
Using federal and provincial legislation as the basis for environmental decisions, the Department shall incorporate the environmental policy into all relevant processes and activities. In so doing, TPW protects the province's environment and enhances the quality of life of Nova Scotians. On an ongoing basis, the Department shall evaluate the environmental benefits and consequences of its activities and implement practices that eliminate or minimize negative environmental impacts.

Policy Objectives

- *Ensure environmental legislation is identified and incorporated, in a timely manner, into relevant departmental decision-making processes and activities.*
- *Ensure the department meets and, if possible, exceeds environmental standards defined in legislation.*
- *Encourage participation by all departmental employees in using best management practices and protecting and promoting environmental responsibility.*
- *Ensure timely coordination and review of programs and projects.*
- *Resolve environmental issues by cooperating/forming partnerships with federal and provincial agencies, other public agencies, public interest groups and the private sector.*
- *Demonstrate commitment to continual improvement and pollution prevention.*

Application
This policy applies to all staff of TPW.

Accountabilities

The Deputy Minister is responsible to:

- *ensure the department adheres to this Policy;*
- *allocate resources for environmental initiatives;*
- *delegate responsibility/authority to trained and competent personnel and hold them accountable by including environmental responsibilities in performance criteria, as is appropriate;*
- *ensure audit results of environmental program initiatives are reviewed and appropriate action taken;*
- *ensure that the department complies with the Environment Act and Regulations;*

Management/Supervisors are responsible to:

- *adhere to this Policy and ensure compliance with the Environment Act and Regulations within workplaces under their supervision;*
- *Integrate best management practices into departmental activities and hold employees accountable for following best practices in performance appraisals;*
- *provide information and training to employees to ensure appropriate environmental practices are performed by employees;*
- *take action immediately upon any report or suspicion of environmentally hazardous situations;*
- *supervise employees and audit work processes to ensure that employees work in an environmentally appropriate manner;*
- *evaluate environmental performance and provide feedback to the Deputy Minister;*

Employees are responsible to:

- *work in accordance with the Environment Act and Regulations;*
- *adhere to this Policy and all other management policies and directives on environmental performance to ensure compliance with the Environment Act and Regulations;*
- *report any and all environmental hazards to the immediate manager/supervisor or a representative of the Environmental Services Section.*

Monitoring

The Department will develop and implement an auditing program to monitor, evaluate and report on environmental performance and compliance with this policy. Monitoring of the policy's implementation, performance and effectiveness will be the responsibility of the Manager of the Environmental Section.

Directives

TPW staff shall comply with applicable environmental legislation.

References

Acts which should be consulted in conjunction with this policy:

- *Nova Scotia Environment Act*
- *Nova Scotia Endangered Species Act*
- *Canadian Environmental Protection Act*

- *Fisheries Act*
- *Species at Risk Act (SARA)*
- *Navigable Waters Protection Act (NWPA)*
- *Canada Wildlife Act*
- *Migratory Birds Convention Act*

This generic EPP is a compilation of environmental procedures and controls to be used by TPW and its Contractors to ensure highway construction minimizes its potential adverse effects on the environment. This EPP has been developed to:

- Provide regulatory agencies with a generic description of the procedures and controls that TPW will follow during highway construction to ensure environmental protection;
- Provide TPW and its Contractors with a comprehensive review of environmental concerns and clear, concise guidance on the methods to be used to address these concerns in the construction of a highway; and
- Facilitate acquisition of approvals and permits required by federal and provincial legislation.

1.2 On-Site Meetings

An on-site meeting with the Project Engineer and such other representative of TPW as may be required, the Contractor, and representatives of DFO, NSEL and other agencies as required, will be held prior to the commencement of any work. Additional meetings may be held as required during the project.

1.3 Responsibilities

The primary responsibility for implementing environmental protection rests with the Contractor's Construction Supervisor. TPW's Project Engineer has the responsibility to: (1) ensure that the Contractor and its staff are fully aware of their obligations; (2) approve and monitor the Contractor's *Work Progression Schedule* (see Section 3.1); (3) advise the Contractor on site-specific environmental and erosion and sediment control (ESC) issues noted in the project EPP and ECPs for various segments of the project; and (4) ensure compliance with all provisions of the Project EPP, ECPs and government approvals/authorizations.

The Contractor is required to designate a person responsible for environmental protection. This person, the Environmental Monitor, will have taken an Erosion and Sediment Control Course approved by TPW, and will be responsible for routine environmental inspection and monitoring, completion of appropriate notes, and the provision of verbal and written feedback to the Contractor's Construction Supervisor and the Project Engineer (or designated inspector).

TPW's Environmental Services Section (ESS) has the responsibility to provide the Project Engineer, and where appropriate the Contractor's Construction Supervisor, with timely advice on the implementation of the Project EPP and ECPs for various segments of the project. ESS staff will also conduct periodic inspections of construction sites and environmental control measures.

1.4 Organization and Use of the EPP

This Generic EPP shall be used by the Contractor as a guide to preventing impacts on the environment as a result of highway construction activities. The reader should note that the Generic EPP is a dynamic document that will be updated as regulations change and as improved protection measures arise. TPW performs an annual review of this Generic EPP and the document will be revised as required. This EPP and all revisions to this EPP will be available through TPW's website:

www.gov.ns.ca/tran/enviroservices/govEPP100.asp

It is the responsibility of all users of this Generic EPP to ensure they have up-to-date protection measures. Regulators will be notified prior to any revisions in the EPP. Proposed revisions must be approved by TPW and the regulators.

This EPP is to be used in conjunction with the following documents, and as such it forms part of contracts:

- The most recent version of TPW's *Standard Specification - Highway Construction and Maintenance* (in particular, Divisions 1.5 and 7);
- Selected Special Provisions to the *Standard Specification* (see **Appendix A**);
- Project EPP and ECPs prepared for various segments of the Project; and
- Culvert Mitigation Plans (CMPs) prepared for works at various water crossings.

This EPP is organized as follows:

- **Section 1** provides TPW's Environmental Policy and details the responsibilities for implementing environmental protection measures;
- **Section 2** provides an overview of items of special consideration in highway construction;
- **Section 3** provides detailed environmental protection measures for highway construction activities in general;
- **Section 4** provides detailed monitoring plans for highway construction activities;
- **Section 5** provides contingency plans for issues that may be encountered during construction;
- **Section 6** provides a list of references used in this document; and
- **Appendices** attached to this EPP provide:
  - Selected Special Provisions
  - Work Progression Schedule
  - Erosion and Sediment Controls - Typical Details
  - EPP for Winter Clearing
  - Construction Specifications for Access Roads
  - Spill Contingency Plan
  - Environmental Inspection Forms

2.0 AREAS OF SPECIAL ENVIRONMENTAL CONSIDERATION

2.1 Wetlands and Watercourses

2.1.1 Wetlands

Wetlands are defined as land that has the water table at, near, or above the land surface, or which is saturated for long enough periods to promote wetland or aquatic processes (National Wetlands Working Group, 1988). Wetlands include bogs, fens, swamps, and marshes. Wetlands are valuable natural resources providing habitat for a variety of wildlife and plant species, both aquatic and terrestrial. For these reasons, the preservation of wetlands through highway design and construction practices is important.

For the construction of 100 Series Highways, the following practices will be used at wetlands to protect wildlife and habitat, and to minimize affects on drainage and water quality:

(a) Travel on wetlands shall be avoided wherever possible. Access roads shall avoid all important wetlands where possible;

(b) Activities will be timed to coincide with low water or frozen conditions, where possible;

(c) Crossings will be restricted to a single location and will occur perpendicular to and at a narrow point on the wetland. Brush matting, swamp matting, ice bridges and floatation tires on vehicles shall be used when crossing as dictated by site conditions and the Project Engineer;

(d) Equipment shall be in good working order and free of leaks. No equipment maintenance including fuelling shall be carried out within 30 m of a wetland;

(e) To avoid spreading of invasive plant species, such as purple loosestrife, any equipment working in an area involving topsoil and vegetation (such as grubbing) shall be cleaned of mud and vegetation prior to leaving the site. Equipment that has been working with topsoil and vegetation prior to arriving on site, shall also be cleaned of mud and vegetation;

(f) Excavation in wetlands shall be carried out by an excavator operating from a dry stable surface to minimize sediment generation;

(g) Excavate only what is absolutely necessary to meet engineering requirements. Excavated material shall not be sidecast in the wetland;

(h) In wetlands associated with sensitive watercrossings, grubbing shall be minimized by the placement of geogrid and geotextile prior to the placement of fill;

(i) Vegetation will be retained where possible to provide wildlife habitat. Where applicable, no work near wetlands will be scheduled during the wildlife's breeding season;

(j) Excavated wetland material shall be retained for placement in the median or along the ROW to improve seeding success. Material may be stored at locations specified by the Project Engineer or applied directly to designated areas to a minimum thickness of 100 mm (± 25 mm). Note that wetland material typically has a very high organic matter content that may require further mixing with inorganic soils prior to spreading. Contact TPW's vegetation specialist, Diane LaRue, for further information (902-424-3682; laruedi@gov.ns.ca);

(k) Excavated material shall be replaced with approved fill material as soon as possible to minimize sloughing, over excavation and generation of sediment;

(l) The fill material shall be clean, coarse fill material with less than 10% fines to minimize the generation of sediment and to promote drainage;

(m) Water control shall be maintained at all times. Water removed from the excavation shall be pumped to an approved sediment control measure (*e.g.*, settlement pond, adjacent vegetated area or filter bag). The Contractor shall ensure that no discharge to adjacent watercourses will occur when total suspended sediment (TSS) concentrations exceed 25 mg/L, or other level noted by NSEL and DFO permits and letters of advice; and

(n) Ditches shall not drain directly to wetlands. Flows must be directed away from wetlands by take-off ditches for dissipation through adjacent vegetated areas.

2.1.2 Watercourses

Watercourses are defined as the bed and shore of every river, stream, lake, creek, pond, spring, lagoon or other natural body of water, and the water therein, within the jurisdiction of the Province, whether it contains water or not. In-stream work will only occur between June 1 and September 30 unless authorized by DFO and NSEL.

TPW is committed to the protection of fish and fish habitat. General protection measures for watercourses are described in Section 3, TPW's *Standard Specification - Highway Construction and Maintenance*, and the DFO (1998) draft document *"Guidelines for the Protection of Fish and Fish Habitat: The Placement and Design of Large Culverts."* More specific measures are attached to government approvals, authorizations, and letters of advice, and will be summarized in the Project EPP. TPW will work with DFO and local watershed groups to design and construct appropriate fish passage at existing and future watercourse crossings.

2.2 Wildlife

2.2.1 General Protection Measures

In the planning of the highway, all sensitive wildlife habitat has been avoided where possible. General protection measures that apply during construction include:

(a) TPW employees and Contractor employees and agents shall not interfere with wildlife and shall not carry firearms within the ROW;

(b) Where important wildlife species are encountered impacts shall be minimized by avoiding noisy, disruptive activities during sensitive wildlife periods (e.g., March to June for nesting bald eagles; see below);

(c) No one shall disturb, move or destroy migratory bird nests. If a nest or young birds are encountered, the Contractor shall cease work in the immediate area of the nest and contact DNR and the Project Engineer;

(d) Should a bald eagle nest be identified, the following approach shall be followed:
   - Within 200 m of a nest, avoid activities that result in significant landscape changes; road and trail use shall be closed from February to mid-June.
   - Within 400 m of a nest, activity is permitted except during the most critical period between March and mid-May;

(e) The Contractor shall consult with the Regional Wildlife Biologist to determine appropriate measures for removing beaver dams and/or nuisance beavers (See Section 2.2.2);

(f) All refuse shall be disposed of at an approved landfill facility. Refuse stored on site prior to removal shall be stored in closed containers; and

(g) Report any nuisance wildlife to the Project Engineer or directly to the local DNR office.

2.2.2 Beaver Dams and Ponds

A procedure has been developed to ensure that the Contractor or TPW field staff safely remove beaver dams and minimize the impact of beaver dam removal on aquatic resources due to loss of pool/pond habitat and the discharge of excessive amounts of sediment and water.

(a) Contact local office of DNR for assistance and/or permit, NSEL for Water Approval, and DFO for advice if watercourses will be affected, prior to proceeding with this work;

(b) The removal of the beaver dam or culvert will be limited to the debris of the structure. The original watercourse bed and bank material may not be removed or disturbed;

(c) Drainage of the ponds should, if possible, take place between June 1st and September 15th, when water is at lower flow levels;

(d) Impounded water will be released over an extended period so as to minimize silt flushing from the impounded area and reduce channel erosion downstream due to the increased discharge and water velocities;

(e) The pond can be drained by pumping down or siphoning. This results in a reduced potential for resuspension of sediment;

(f) The maximum allowable depth of water spilling over the structure at the drainage point is 10 cm (4 inches). The width of the opening will be no greater than the width of the watercourse downstream of the dam until the pond has been drained;

(g) When dismantling beaver dams, the majority of the work should be performed using hand tools; remove only enough debris to start running the flow of water under controlled discharge;

(h) If using machinery, only diesel powered cabled winches (not electrical) should be used to remove debris from dams and pipes;

(i) All debris removed from the beaver dam will be placed at a location above the high water mark so as not to re-enter the stream;

(j) If it is intended to remove accumulated sediment or organic material from a beaver pond area, after a dam has been breached, this material be allowed sufficient time to completely dry before it is removed. All appropriate permits for working near a watercourse must be obtained for such a removal project;

(k) In a location where it is impossible to eliminate dams, control the level of water by constructing and installing a temporary structure (water level control pipes; see DNR document *"When Beaver Become a Nuisance"*);

(l) For a small to medium sized culvert in locations where dams are totally dismantled, install culvert protectors which can be easily removed if the beaver rebuilds his dam (see DNR document *"When Beaver Become a Nuisance"*);

(m) In situations where a culvert must remain open to prevent road washouts during flood conditions, but a beaver pond is acceptable, a culvert guard should be constructed (see DNR document *"When Beaver Become a Nuisance"*); and

(o) The excavation of sediment from the former pond site must be conducted in a manner to ensure that suspended sediment and organic matter do not re-enter the watercourse.

In general:

- Whenever possible, defer the removal of the nuisance beaver(s) until a beaver trapping season is in effect. Licensed trapper assistance should be sought through DNR;

- Nuisance beavers shall be dead-trapped with 330 conibear traps (or other DNR approved trap) set in water-based sets (preferably submerged) to avoid possible contact with children and pets;
- Shooting of nuisance beaver should be used as a last resort after trapping has proven unsuccessful; and
- Every effort should be made to remove all the beavers at a site before destroying the beaver lodge.

2.3 Habitat for Species at Risk and Rare Species

The environmental impact assessment process routinely identifies species at-risk and rare species, as well as their habitats in the project study area, and TPW mitigates impacts through avoidance. However, in the event that designated at-risk species are encountered during construction, the Project Engineer and TPW's Environmental Services Section will be notified, and DNR and/or Environment Canada contacted for advice. Designated species are listed on both provincial and federal government websites:

http://www.gov.ns.ca/natr/wildlife/endngrd/endg.htm
http://www.sararegistry.gc.ca/species/default_e.cfm

2.4 Heritage Resources

Heritage resources include sites and artifacts of value for their archaeological or historic importance or interest. As noted above for species-at-risk, TPW routinely mitigates impacts through avoidance.

Should any resources or human remains be encountered during construction, the Contractor shall follow the contingency procedures described in Section 5.2.

2.5 Land Use and Access

Highway ROWs traverse both Crown lands and privately held lands, and may affect a variety of land uses. TPW will minimize impairment of access to private lands through awareness and maintenance of access where possible adhering to the following principles:

- being cognizant of access roads and driveways from the corridor to these lands and maintaining them as passable, when and wherever possible;
- replacement of roadside culvert structures where effected by the work;
- replacement of access driveways to private lands where impacted by the work;
- communication with emergency response organizations to allow for alternative evacuation protocols in the event of a fire or spill incident; and
- through general cooperation with land owners affected by the work.

In order to minimize inconvenience to surrounding landowners and users, the Contractor shall:

(a) Control litter and construction waste on site including off-site office sites and camps. All waste shall be removed from the job site and disposed of in accordance with NSEL and municipal requirements;
(b) Not burn construction waste or refuse;

(c) Obtain from the Project Engineer information on any stipulations in landowner agreements which may impact on the Contractor's work, e.g. stipulations regarding use of access roads;

(d) Schedule work in residential areas or near sensitive receptors such as hospitals to minimize noise disturbance, where practical; and

(e) Make every effort to carry out the work in a manner which causes minimum inconvenience to the landowner.

2.6 Areas with Potential Acid Generating Bedrock

Disturbance of sulfide-bearing bedrock may result in acid drainage. The Meguma Group, particularly the Halifax Formation (slates) and its transition zone with the Goldenville Formation (quartzite and greywacke), is often rich in sulfides (iron pyrite and arsenopyrite). Coal bearing units may also have acid generating potential. Whenever possible, TPW avoids these areas. However, if coal or slates are encountered, the Contractor will immediately notify the Project Engineer for advice on how to proceed. Samples will be required for subsequent testing of acid-generating potential. High levels will mandate NSEL, DFO and Environment Canada notification, and the preparation of an ECP to treat/handle the materials in accordance with the Nova Scotia "*Sulphide Bearing Material Disposal Regulations*." Some of the concerns and protection measures are outlined in Section 5.4 of this document.

2.7 Areas with High Soil Erodibility

If soils have been identified as having a moderate to high potential for erosion (*i.e.*, through the environmental impact assessment process), the Contractor will be directed to take additional precautions with regards to erosion and sediment control. Details will be provided in the Project EPP and the ECPs for appropriate segments of the highway project.

3.0 ENVIRONMENTAL PROTECTION MEASURES

3.1 Work Progression Schedule

The purpose of the work progression schedule is to ensure that construction in any work area is carried out continuously from initiation to completion; to ensure orderly progression of the work; and to offer effective protection of the environment by minimizing both the time and amount of exposed soil on construction sites.

3.1.1 Work Areas

A "work area" is an area, defined by station chainages, the limits of which shall be established by the Contractor with the approval of the Project Engineer prior to commencement of work. The size of the work area shall be determined with due consideration to the Contractor's ability to complete all grading work, to the lines and grades shown on the plans, seeding and final slope protection within 30 calendar days. Work will commence with the start of grubbing in that work area, and will be considered complete when the specified cover material is applied (*e.g.*, straw/hay/compost/bark mulch, erosion control blanket, Clear Stone, sod, hydroseeding).

The Work Progression Schedule (Appendix B) and a Contingency Plan for failure of ESC measures (see Section 5.5) shall be completed by the Contractor and approved by the Project Engineer prior to commencement of any grubbing. Further information about environmental timing constraints applicable to a project will be detailed in the Project EPP.

3.1.2 Unforseen Circumstances

If conditions are encountered in an active work area which requires extra care or work which the Contractor is unable to continue at that time, the Contractor will be allowed to open up additional work area(s) with the approval of the Project Engineer only after the original work area is temporarily protected, *i.e.*, straw/hay/compost/bark mulch.

If unforseen circumstances occur, the 30 calendar day period may be extended with the approval of the Project Engineer. This extension must be accompanied by a written report outlining the need for the extension and the measures to be taken to control erosion and sedimentation.

Inconvenience to the Contractor, poor planning or not having adequate or appropriate equipment will not be considered unforeseen circumstances.

3.1.3 Non-Compliance

Once the grubbing operation within a specific work area has begun, work shall be continuous from grubbing through to the placement of seed (including fertilizer, lime) and final slope protection, where required. If after 30 calendar days the above described work is not completed, then:

(a) No additional work area(s) will be allowed to commence until these work areas are completed; and
(b) All work areas will be immediately protected with straw/hay or compost/bark mulch.

If, in the Project Engineer's judgement, there is non-compliance with ESC provisions, or if the Contractor receives a warning or citation from NSEL or DFO, then corrective action may require a shutdown of construction activities, until such time as the non-compliance is satisfactorily corrected.

3.2 Erosion and Sediment Control

Erosion and sedimentation can occur at any time during the construction of the highway. The highest potential for erosion occurs during the grubbing, grading, and culvert/structure installation. The emphasis in all of TPW's construction projects is to **prevent erosion rather than treat sediment**.

TPW defines seven principles of erosion and sediment control (further information is available in the annual ESC Course jointly prepared by TPW, NSEL, DFO, and Dalhousie University - Centre for Water Resource Studies (*e.g.*, CWRS *et al.*, 2004)):

1. Go gently into this good site.
2. Keep clean water clean.
3. Minimize amount of exposed soil.
4. Minimize time of exposure (of soil).
5. Keep sediment on site.
6. Avoid steep slopes.
7. Have a contingency plan and the resources for emergencies.

In order to meet these principles and minimize the impacts related to erosion and sedimentation, TPW has adopted the erosion and sediment control (ESC) practices and techniques as outlined in the following sections.

TPW's "*Standard Specification - Highway Construction and Maintenance*" and NSEL's *"Erosion and Sedimentation Control Handbook for Construction Sites"* are the principal reference documents for all ESC measures. The key elements are summarized in this EPP along with five new "Selected Special Provisions" (see Appendix A: Supplying and Placing Compost, Supplying and Placing Bark/Compost Berms for Sediment Control, Supplying and Placing Bark for Erosion Control, Wire Backed Silt Fence Barrier, Erosion and Sediment Control Plans for Borrow Pits).

The Transportation Association of Canada (TAC) has recently finalized its "National Guide to Erosion and Sediment Control on Roadway Projects" and the Guide is now available for purchase (see http://www.tac-atc.ca/english/index.cfm). This guide contains a synthesis of Canadian and international practice and numerous Best Management Practices (BMPs) for project planning, ESC plans, site management, erosion control and sediment control.

The following sections provide an overview of erosion types, factors effecting rates of erosion, effects of sedimentation, and recommended ESC measures.

3.2.1 Erosion

Erosion is defined as the gradual wearing away of the land surface by the action of water, wind and ice. Water is the leading cause of erosion in highway construction projects in Nova Scotia. There are several types of erosion that can affect exposed soils and frequently these types of erosion will work in combination. Erosion types include:

Splash	Raindrops impact the ground at 2-9 m/s and dislodge and scatter soil particles.
Sheet	Refers to the removal of a fairly uniform layer of soil by shallow sheets of water, without the development of channels. While sheet erosion will rarely detach soil particles, it is primarily responsible for the transportation of soil particles detached by splash erosion. Shallow surface or sheet flow only moves a few metres across land before concentrating in surface irregularities causing rills.
Rill	Rills will begin to develop as sheet flow concentrates in low spots on the surface. Rills are small channels on the order of 1-10 cm in depth. This concentration of flow is able to detach and transport soil particles.
Gully	Gully erosion occurs as flow in rills combines into larger channels. Runoff in gullies has more erosive powers than that in rills, and is capable of transporting large amounts of soil. Continued growth of gullies can lead to slumps, landslides and major damage to roads, adjacent lands (up and down-gradient), and fish habitat.

3.2.2 Factors Influencing Erosion

Soil Type

Runoff occurs when the rate of rainfall or snowmelt exceeds the infiltration capacity of the soil, and the surface water retention. Soils containing high percentages of silt and fine sands are the most erodible (*i.e.*, muddy soils typical of alluvial, colluvial and marine deposits). Clay has low erodibility because it acts as a binder, however, once detached the fine particles are easily transported by water and tend to remain in suspension for a long time. Removal of these particles from construction runoff will require the use of settlement (settling) ponds and probably a flocculant to clarify the water prior to discharge from the construction site.

In contrast, coarse sands are easily detached, but have low erodibility because they are difficult to transport. Clear, well-drained and well-graded gravel and gravel-sand mixtures are the least erodible. Soils which are high in organic matter tend to increase infiltration and soil permeability, decreasing their erodibility, provided they are not subject to deep rutting.

Average loss rates of soil from bare ground are on the order of 63 m^3/ha (33 yd^3/acre) or 67 tonnes/ha (30 tons/acre). Because the best soils are usually lost first, excess loading of topsoil nutrients into lakes and streams can also lead to a variety of eutrophication-related problems.

Vegetation

Maintaining or establishing vegetation is important to preventing erosion as vegetation will:

- Intercept and reduce the energy of falling raindrops;
- Reduce runoff velocity;
- Filter out sediment;
- Increase infiltration of water to the soil;
- Hold soil in place with roots; and
- Remove subsurface water between rainfalls through evapo-transpiration.

Table 2 provides a comparison of soil loss under various types of vegetation against unprotected ground. Table 3 compares the effectiveness of selected ground covers in reducing erosion.

Table 2
Runoff and Soil Loss by Land Use

Land Use	Runoff as Percent of Rainfall (silt loam, 7% slope)	Annual Soil Loss by Land Use (tonnes/km^2)
Woods	0.009	0.8
Grass	0.29	4
Crop rotation	8.6	4400
Bare ground	29.1	26640

Source Unknown

Table 3
Effectiveness of Selected Ground Covers

Cover Type	% Reduction in Soil Loss
Grass - 0 to 60 days	0 - 16
Grass - 2 to 12 months	60 - 95
Grass - >12 months	90 - 99
Woodchips (15 to 25 tonnes/ha)	80 - 95
Straw (2 to 10 tonnes/ha)	80 - 97
Chemical Mulches	90

J. Li (1997) Erosion and Sediment Control Training Manual. Report Prepared for the Ontario Ministry of Environment and Energy. Toronto, Ontario.

Further information on vegetative covers for Nova Scotian Highways, together with advice on best practices for establishment and long-term maintenance, are presented in TPW's (2003) "*Integrated Roadside Vegetation Manual*" and its companion "*Roadside Vegetation Field Manual.*"

Topography

The size, shape and slope characteristics all influence the amount and rate of runoff. As the length and the gradient of the slope increases, so does the velocity and rate of runoff and thus the erosion potential. Slope orientation can also be a factor. For example, south/north facing slopes may have different abilities to reestablish vegetation due to duration of snow cover and amount of sunlight received.

Weather, Climate/Microclimate and Hydrogeology Interactions

Rainfall is the dominant climatic factor which contributes to erosion. Seasonal changes also play a role. For example, when precipitation falls as snow, no erosion will take place. When melting snow adds to runoff, especially when combined with a rain event, erosion potential is increased.

Similarly, frozen ground is generally erosion resistant, however soils with high moisture content are subject to heaving by freezing action and are very easily eroded upon thawing. High moisture content may arise because of climatic factors, microclimate (orientation to the sun and wind), soil organic matter content, groundwater seepage to the surface (springs), and seasonal/storm-related variations in the water table.

The highest potential for erosion occurs when intensive rainfall (measured as both intensity and duration) combines with open or unstable ground conditions (caused by snow melt, or melting of frost). This will generally coincide with grubbing (typically in the Spring) and maximum earthworks exposure in the Summer and Fall. Contractors shall be prepared for the worst and ready to implement their contingency plans (see Section 5.5).

3.2.3 Sedimentation

Sedimentation is the deposition and accumulation of detached soil particles. Sedimentation can have the following impacts on watercourses, waterbodies and wetlands:

- Alters oxygen balance in water;
- Clogs small pebbles fish use for spawning.;
- Suffocation of eggs and fry of salmon and trout;
- Suffocation of aquatic insects (an integral part of the food supply of trout and salmon);
- At high concentrations, sediment can suffocate fish;
- Clouds the water and prevents salmonoids (trout, salmon) from seeing their prey;
- Transport toxic materials;
- Increase water temperature to uninhabitable levels;
- Fills in and may alter hydrology of wetlands; and
- Diminishes drinking water quality.

3.2.4 Erosion and Sediment Control - General Requirements

Erosion control techniques to be implemented on highway construction shall be implemented in any area where there is exposed soil and a potential for erosion. The following sections provide techniques available for use by the Contractor to ensure runoff leaving the site meets NSEL and DFO criterion of less than 25 mg/L total suspended solids (TSS).

While the Project Engineer is available to advise the Contractor on protection measures, **the Contractor has the ultimate responsibility to install, maintain, and monitor ESC measures until the completion of the contract. The Project Engineer and TPW inspectors will conduct daily inspections.**

The following general requirements shall be adhered to by the Contractor:

(a) Adhere to NSEL (1997) *Watercourse Alteration Specifications*, including the on-site availability of all Approvals and Terms and Conditions;

(b) Educate all construction personnel about Project Approvals, Terms and Conditions, and the importance of ESC measures and plans;

(c) Notify Project Engineer and NSEL of changes and modifications to ESC measures and plans prior to implementation;

(d) Travel shall be restricted as much as possible to areas between slopes stakes in cuts and fills;

(e) No fording of watercourses and no equipment to work within watercourses. Wetlands are to be avoided. If avoidance is not practical, the Contractor is instructed to schedule work during winter, and/or use swamp mats, non-merchantable wood corduroy, and/or flotation tires to reduce rutting;

(f) Access ways on the ROW and approaches to water crossings shall be stabilized to support the anticipated traffic. Maintain access roads to prevent erosion and sedimentation;

(g) Adhere to construction monitoring/inspection programs noted in this EPP (Section 4). Maintain daily records, discuss proposed changes and alterations with the Project Engineer prior to implementation, and immediately report potential problems to the Project Engineer or TPW inspectors (and NSEL/DFO depending upon statements in the Project Approvals and Terms and Conditions).

(h) Runoff shall be controlled and sediment will be prevented from leaving the site at all times. In addition, to ensure ESC measures are maintained during construction, the Contractor shall periodically inspect all installed ESC measures (especially before and after storm events) and protect exposed soil with either temporary or permanent covers as soon as areas are brought to grade;

(i) Install drainage and siltation control devices prior to grubbing. Install Type 2 Silt Fence, also known as 'Wire Backed Silt Fence Barrier' (see *Selected Special Provisions* in Appendix A), near watercourses and monitor condition daily. Any deterioration/damage is to be repaired immediately or operations ceased until repairs are completed;

(j) Divert clean water from undisturbed areas around the site using berms or lined channels or carry the water across the site in lined channels or pipes;

(k) Maintain on site sufficient quantities of silt fence barrier, straw/hay mulch, compost, bark, Clear Stone, erosion control blanket and geotextile fabric to address ESC issues as the work progresses, and fulfill the requirements of the Contingency Plan for failure of ESC measures (see Section 5.5);

(l) Maintain sufficient personnel and equipment to manage erosion and sediment control during storm events and other emergency situations (*e.g.*, failure of ESC measures; Section 5.5);

(m) Should a storm event be predicted, the Contractor shall inspect all installed ESC measures and implement additional controls as necessary to ensure runoff leaving the site meets the <25 mg/L TSS criterion. The Contractor shall also be prepared to implement a Contingency Plan to deal with emergencies (see Section 5.5 for further guidance);

(n) Steep slopes, erodible soils, wet areas, and watercourses are areas of high erosion potential and the Contractor shall exercise extra caution in these areas. Point source discharges will be minimized and sheet flow maximized where appropriate;

(o) All in-stream work to be carried out "in isolation from flowing waters" and strictly following NSEL and DFO Approvals, Terms and Conditions, and Letters of Advice;

(p) Dewatering flows to be pumped to appropriate settlement ponds or adjacent vegetated areas, and no discharge to the watercourse when TSS levels exceed 25 mg/L;

(q) The length of time that soil is exposed shall be minimized. This will be achieved by minimizing grubbing to the extent necessary to meet engineering requirements, avoiding working during wet periods, and staging construction schedules using the Work Progression Schedule to minimize the length of time soils are exposed;

(r) Stabilization prior to area being brought to final grade may be required if the area has a high potential for erosion that could adversely impact a watercourse;

(s) Erodible soils shall be stabilized using slope roughening, rip-rap and filter fabric, or by rehabilitating by seeding, mulching, erosion control blankets, or sod immediately after grading is completed;

(t) Surface runoff will be directed to vegetated areas where possible, or via stabilized ditch systems which follow similar routing to natural existing drainage patterns;

(u) Existing drainage provisions for the existing highway will be used where possible; and

(v) ESC measures for borrow pits shall be prepared by the Contractor and submitted to the Project Engineer for review prior to construction commencing.

The following subsections provide a summary of the installation and maintenance of ESC measures commonly used in highway work. These measures are to be installed in accordance with Division 7 of TPW's *Standard Specifications*, Selected Special Provisions (see Appendix A), and, as a minimum, at locations designated in ECPs prepared for various segments of the project. This does not alleviate the responsibility of the Contractor to implement ESC measures on its own accord to prevent erosion and to ensure transport of sediment from the site is minimized. Typical details for ESC measures are provided in Appendix C. Additional guidance is available in the course binder for the annual ESC Course jointly prepared by TPW and Dalhousie University - Centre for Water Resource Studies (*e.g.*, CWRS *et al.*, 2004).

3.3 Clearing

Clearing work involves travel along the ROW, clearing of trees, piling of merchantable timber and the chipping of all non-salvageable material such as brush, slashings, limbs, fallen branches, and other surface litter. The primary concern during clearing is to prevent ground disturbance that may result in the sedimentation of watercourses and wetlands.

3.3.1 General Protection Measures

(a) Where possible, all clearing shall take place during the winter months on frozen ground (see Appendix D for further information about winter clearing). All vehicles shall use flotation tires, properly sized for the vehicle. When the Project Engineer deems that ground conditions are not suitable for machinery use, hand clearing will be done;

(b) Under no circumstance is the soil to be disturbed within the designated buffer zone of any watercourse. The buffer zones for clearing are provided in the environmental control plans and may be increased by the Project Engineer if site conditions warrant during construction;

(c) Trees within this buffer zone shall be hand cleared or cleared by equipment that can reach into the buffer zone without disturbing the soil;

(d) Any merchantable timber or non-salvageable material removed from the buffer zone shall be done in such a manner that does not result in disturbance of the surface or exposure of the underlying soil. Brush mats or swamp mats shall be used to protect the surface. Brush mats should be between 300 and 500 mm in height. When ground conditions are not suitable for machinery use, even with matting, clearing shall be done by hand;

(e) The chipped material shall be left in place to cover the ground and minimize ground disturbance everywhere except within buffer zones;

(f) Only when avoidance is impossible, will a water crossing be implemented. Equipment will not be permitted to enter a watercourse. To facilitate water crossings, temporary bridges or ice bridges (crossings less than 5 m in width) will be used. Temporary bridges are defined as portable structures placed across a watercourse for a period of time ranging from less than one day to one or more weeks. They shall be removed when the work in the area is completed;

(g) Temporary bridges are not required in the following circumstances:
  - Watercourse channel is not defined and is vegetated (*i.e.*, not gravel). This crossing requires NSEL approval and the installation of a brush mat to protect the area;
  - Watercourse contains no water at the time and provided the vehicles cause no rutting or disturbance to the bed or shoreline. The crossing requires NSEL approval;
  - During frozen conditions, vehicles may cross watercourses that are < 5 m in width *via* ice bridges, provided the ice cover is sufficient to hold the weight of the vehicles and the bed or shoreline are not disturbed. DFO is not in favour of ice bridges, therefore, permission to use ice bridges will only be considered under special circumstances;
  - If the EPP identifies site-specific water crossings and fording is permitted during low flow conditions. DFO is not in favour of fording watercourses, therefore, permission to ford will only be considered under special circumstances; and
  - Permit specifications and NSEL staff have approved alternative methods of crossing;

(h) Crossings shall be restricted to a single location and will occur perpendicular to the watercourse and at a narrow point on the watercourse. Wherever possible, the crossing site must exhibit a stable soil type and gentle approach slopes;

(i) A buffer zone shall be maintained on each side of a watercourse. In this zone, a 3 m wide travel route may be cut. All slashing and construction debris will be removed by hand; by cable, or by equipment able to reach into the buffer zone. Slash and debris shall be disposed of above the high water mark and away from the watercourse, unless it can be used as brush matting;

(j) The temporary bridge shall span the entire watercourse. Placement of log cribbing or rock in the watercourse to support the bridge is prohibited unless otherwise authorized by the Project Engineer and DFO;

(k) The approaches to the temporary crossing shall be protected from rutting by the use of brush mats, swamp mats, non-merchantable wood corduroy, or rock;

(l) Trees shall be felled away from the watercourse during surveying, clearing and maintenance operation. Trees felled within the high water mark shall be removed immediately;

(m) When bank or approach slopes are composed of erodible soil, riprap, filter fabric or other stabilization measures will be used. If mechanical stabilization is not considered sufficient to ensure stability or prevent silt entering the watercourse, then seeding, mulching, sodding or planting as soon as possible following clearing or at the end of grading operations is required;

(n) The temporary water crossings shall not restrict or block natural drainage; and

(o) The temporary crossing shall be removed as soon as possible when it is no longer required. If any disturbance to the creek banks has occurred due to bridge removal, the Contractor shall immediately stabilize the banks with Clear Stone or rock.

3.3.2 Disposal of Clearing Waste

Burning is not permitted on 100 Series highways. TPW will accept the following methods for the disposal of surplus brush, slash, or non-merchantable timber.

Chipping

(a) Wherever possible, chips shall be spread on side slopes and back slopes as part of final slope dressing;

(b) Large stockpiles of chips shall be avoided;

(c) Chips shall be disposed of where they will not run into a watercourse or block ditches, culverts, or drains. Chips shall not be disposed of within buffer zones; and

(d) If feasible, stumps shall be ground using a stump grinder.

Burying

Material that cannot not be disposed of by the above methods shall be buried. The material is permitted to be buried in the following locations:

(a) In a grubbings disposal area obtained by the Contractor;

(b) Buried in pits, or in the toe of slopes or outside the theoretical slope with the approval of the Project Engineer; and

(c) In a suitable location in the ROW outside the roadway and with the approval of the Project Engineer.

3.4 Culvert Installation

For the purposes of this document, a watercourse is defined as the bed and shore of every natural, river, stream, lake, creek or pond, whether or not it contains water.

This section is intended to cover the protection measures associated with culvert installation including ESC measures, water (flow) control, and temporary diversions of watercourses.

Temporary crossings that may be associated with culvert installation shall be carried out using the general protection measures described in Section 3.2.

Culvert design will address potential climate change impacts through use of 1:100 year design storm based on a range of runoff coefficients developed from actual streamflow response to a 1:100 year event (hourly flows). Where applicable, culverts and culvert extensions shall also be designed based on DFO specifications for fish passage (see DFO's (1998) *Guidelines for the Protection of Fish and Fish Habitat: The Placement and Design of Large Culverts*). Further details about culverts requiring fish passage will be provided on culvert mitigation plans (CMPs) prepared for the project.

Note: Blasting in or near watercourses must receive DFO approval (see "*Guidelines for Use of Explosives in or Near Canadian Fisheries Waters*"; Wright and Hopky, 1998).

Protection Measures

(a) Prior to the commencement of any work associated with culvert construction, an on-site meeting shall be arranged between the Project Engineer, DFO, NSEL, and the Contractor to discuss the construction procedures;

(b) The Contractor shall adhere to any further stipulations discussed and agreed to by the approved parties as a result of the above on-site meeting. These stipulations shall form part of the Contract;

(c) All work shall conform to the "*NS Watercourse Alteration Specifications* (1997)", the TPW *Standard Specification*; and the Terms and Conditions of NSEL and DFO Approvals;

(d) An Environmental Monitor will be on-site at all times during culvert construction to assist construction personnel as required, collect water samples, and ensure compliance to DFO and NSEL Authorizations, Approvals and Letters of Advice;

(e) All in-stream work shall be completed between June 1 and September 30, and "in isolation from flowing water";

(f) Machinery shall avoid work near watercourses unless specifically permitted;

(g) Prior to work on culverts, a Type 2 Silt Fence shall be installed on both sides of the watercourse at a location delineating the edge of a buffer zone. This buffer zone shall be 75 m on either side of the watercourse unless otherwise specified. The Contractor will monitor the silt fence daily and any damage/deterioration will be repaired immediately or operations ceased until repairs are complete;

(h) Install erosion and sediment control measures as detailed in Appendix C and on the CMPs;

(i) A buffer zone shall be maintained on both sides of each watercourse within which no grubbing or filling is to take place until the drainage structure and the erosion control devices are installed, with the exception of the footprint under the proposed culvert and stream diversion or the access road and working platform necessary to construct the culvert. Buffer zones will be shown on CMPs and ECPs for various segments of the project;

(j) During construction, temporary access roads and working areas within the buffer zone shall be adequately surfaced with Clear Stone and properly maintained to prevent siltation of the watercourse;

(k) Excavation shall be carried out in the dry, either by (1) building the new structure in the dry and diverting the stream into it upon completion, (2) constructing a temporary plastic-lined diversion channel (see Appendix C), (3) installing sheet pile barriers [cofferdam] for culvert footings of span structures, or (4) damming the stream and pumping the water around the site. If the dam and pump option is used for water control, the Contractor shall ensure the pumping operation is monitored 24 hours per day to ensure that adequate flow is provided at all times to downstream areas. Backup pumps and hoses shall also be available on-site.

(l) Temporary diversions channels shall be constructed to resemble the existing channel in cross section or as directed by the Project Engineer, and must be designed to pass the maximum discharge anticipated during the period of construction. The entire walls and floor of the diversion channel shall be lined with polyethylene or a geotextile;

(m) Cofferdams shall be made of sheetpile barriers or sandbags covered with plastic;

(n) All fish stranded when the stream is temporarily diverted or re-directed into the completed culvert shall be rescued by electrofishing or netting and placed in the new watercourse. DFO shall be notified prior to the transfer of fish;

(o) Dewatering flow from sheetpile barriers, and other intercepted water from the construction site shall be pumped, or directed to, appropriate settlement ponds or adjacent vegetated areas. The Contractor will ensure that no discharge to adjacent watercourses will occur when TSS concentrations exceed the 25 mg/L criterion; and

(p) Excavated material and construction debris shall be disposed of away from the watercourse so that rain or high flow conditions will not return the sediment and debris to the watercourse (unless the material is being temporarily stored for future restoration purposes; wetland and aquatic vegetation and associated root mat may be stored with the knowledge and approval of the Project Engineer and government regulators; enhanced ESC measures will be required, *e.g.*, turbidity curtains and containment berms).

3.5 Structures

Construction of structures, in particular, excavation of foundations in or adjacent to watercourses and wetlands present environmental issues related to water control and erosion and sediment control.

General measures for structure construction are provided below:

(a) Excavation for foundations in or near a watercourse or wetland shall be done to prevent siltation. Excavations shall be isolated from the watercourse or wetland using methods such as cofferdams and turbidity curtains as directed by the site-specific plans and the Project Engineer. All work in watercourses or waterbodies must have prior approval of NSEL, DFO, and if required, the Coast Guard (*Navigable Waters Protection Act* [NWPA] approval);

(b) Water pumped from an excavation shall not be discharged directly to the watercourse or wetland and must be filtered through vegetation or by the use of a filter bag on the end of the discharge hose (or temporarily stored in appropriate-sized settlement ponds). Water reentering the watercourse shall not have a TSS concentration exceeding 25 mg/L;

(c) Rock protection shall not consist of net acid-generating rock or rock that has the potential to leach heavy metals or arsenic. The Contractor shall provide test results from the source of the material to the Project Engineer for approval prior to placing the rock; and

(d) Storage and handling of chemicals used in structure construction shall follow the procedures detailed in section 3.15.

3.6 Grubbing

Grubbing is the removal of all organic material and unsuitable soil above the underlying subsoil. It also consists of the removal and disposal of all stumps, roots, downed timber, embedded logs, humus, root mat and topsoil from areas of excavations and embankments or other areas as directed by the Project Engineer.

Protection Measures

(a) The area to be grubbed shall not extend into the buffer zones shown on the ECPs for various segments of the Project until completion of culvert/structure installation and all ESC measures are in place;

(b) The areas where debris from the grubbing operation will be stored shall be selected to minimize any potential impact on watercourses (minimum distance of 100 m from any watercourse), unless the material is being temporarily stored for future restoration of the stream banks or lakeshore (*i.e.*, the riparian zone). As noted earlier, wetland and aquatic vegetation and associated root mat may be stored with the knowledge and approval of the Project Engineer and government regulators (enhanced ESC measures such as turbidity curtains and containment barriers will be required);

(c) Grubbing debris shall have appropriate ESC measures applied;

(d) Areas used for the disposal of material removed in the grubbing operation shall not obstruct drainage patterns nor shall runoff from the disposal areas contaminate or cause siltation of any streams or wetlands;

(e) If approved by the Project Engineer, grubbing and excess materials can be used to flatten slopes, construct berms, or be deposited as directed by the Project Engineer, provided it presents a neat appearance and does not adversely affect abutting property; and

(f) The grubbing debris areas shall be seeded and dressed to establish vegetation as soon as possible.

3.6.1 Topsoil

Topsoil is defined as the surface layer of soil that has been processed (using a root rake or other means) to be free from woody vegetation, stumps, roots, or other debris that would prevent proper placement of the topsoil when finishing slopes and other areas. The material shall also be free from any material toxic to plant growth. Specialty topsoil for application in the riparian zone of streams and lakes may also be specified to ensure maximum germination and growth of vegetation. Further details are provided in a new Special Provision (see Appendix A).

The pH of topsoil shall be between 5.5 and 7.6. If topsoil has a pH less than 5.5, the pH shall be increased by applying pulverized limestone at a rate necessary to attain a 6.5 pH value. Topsoil shall have an organic content (% of dry weight) of 2.0%. If the organic content is less than 2.0%, it shall be increased by adding peat or composted material at a rate necessary to attain the minimum organic content.

Other guidance is summarized below:

(a) Topsoil shall be retained from grubbing operations wherever possible, and placed on sideslopes, backslopes and the medians to improve the establishment of vegetation;

(b) Topsoil shall be removed from construction surfaces and stockpiled in consultation with the Project Engineer. If space within the right of way is not available for stockpiling of topsoil, the Contractor shall secure suitable areas elsewhere for the duration of the contract;
(c) The Contractor shall employ ESC measures to reduce runoff and minimize loss of topsoil due to erosion;
(d) Processed topsoil shall be free from stones, clay lumps or similar objects larger than 50 mm in greatest dimension;
(e) Sod and herbaceous growth such as grass, weeds and shrubs need not be removed but shall be thoroughly broken up and mixed with the topsoil during handling operations;
(f) Areas where topsoil is to be placed shall be fine graded to a uniform surface. It shall be free of all vegetation and other debris, and free from stones which would not be covered by the specified depth of topsoil; and
(g) Topsoil shall be spread to a uniform depth of approximately 100 mm on designated areas.

3.6.2 Settlement Ponds

Settlement or settling/sedimentation ponds are designed to intercept and retain sediment-laden runoff so that sediment may settle out, reducing the amount of sediment leaving the disturbed area, and protecting areas and watercourses downstream of the pond from excessive sedimentation. **Settlement ponds do not solve erosion problems** - they are used as a 'last resort' to treat runoff which has already become silt laden.

Location

Settlement ponds may be required where larger flows of water or larger drainage areas are encountered. Ponds shall not be constructed in a location that cannot be accessed later in the construction process for maintenance purposes or removal (*e.g.*, near the base of fills).

Construction

Unless otherwise directed by the Project Engineer, ponds shall be constructed in accordance with the *Standard Specification* (Division 7, Section 3), Drawing HS708 (see Appendix C), and the following guidance:

(a) Ponds shown on ECPs for various segments of the Project shall be constructed prior to grubbing upstream of the pond;
(b) Ponds shall be constructed in the locations shown on the ECPs or as directed by the Project Engineer, and shall be of sufficient size to filter all runoff from the highway ROW to be drained;
(c) As per the *NS Watercourse Alteration Specifications*, the minimum size requirement is 190 m^3 of storage for each hectare of exposed construction area (or 0.0625 acre-feet per acre);
(d) Size and number of ponds can be minimized by reducing the area exposed soil; and
(e) Flocculating agents may be required for adequate settling of fine colloidal soils and clays. The Contractor may be required to use flocculating agents if pond discharge results in a TSS concentration in excess of 25 mg/L at the ROW boundary or entering a watercourse.

Maintenance

(a) Ponds shall be cleaned out when the storage is 50% full. Filters must be kept free of silt build-up;

(b) The water level shall be such that the pond can hold water in the next rain event; and
(c) The ponds shall only be removed on the direction of the Project Engineer.

3.6.3 Sediment Barriers

Sediment barriers are used as a temporary perimeter control to intercept sediment-laden runoff as it leaves the construction area. The barrier will slow flow and allow sediment to settle out before it enters a ditch or watercourse. Fine-grained sediment is trapped, while storm runoff may pass through at a slower rate. Sediment barriers are to be used to intercept sheet runoff only. They are not effective in ditches and are not permitted in watercourses, or when continuous flow and/or moderate to high velocities are expected.

Sediment Barriers can come in several forms:
- Straw/hay bale barriers;
- Silt fence barrier and 'Wire backed silt fence barrier' (Type 2 Silt Fence; see Appendix A);
- Berm barriers; and
- Sandbag barriers.

Other sediment barriers that are available for use (with approval of the Project Engineer), but not listed in the *Standard Specification* include coir logs, triangular Silt Dyke™, and Enviro Berm®.

The most commonly used barrier in highway construction is the silt fence barrier, however, berm and sandbag barriers can be used in situations where longer term protection is required. While berms may be more costly to construct, they offer the benefit of lower maintenance costs. In some situations, a berm barrier can be left following construction as a permanent ESC measure with the approval of the Project Engineer.

Locations

Sediment barriers are to be located in a continuous fashion, perpendicular to the flow. They shall be installed in the following areas:
- to delineate the construction site;
- to delineate buffer zones;
- toe of fill slopes;
- the downhill side of large cut areas; and
- along watercourses and drainage swales.

During the course of construction, it may be necessary to install sediment barriers at other locations to contain sediment from excavations, embankments or temporary stockpiles of grubbings, topsoil, root mat and vegetation plugs.

Construction
- Barriers shall be constructed in accordance with the *Standard Specification* (Division 7, Section 1) and/or any Special Provisions (e.g., Bark/Compost Berm and Wire Backed Silt Fence Barrier; see Appendix A);
- Sediment barriers are to be installed prior to any grubbing work commencing on the construction site;
- Barriers are not to be used in a ditch as flow checks as they are not designed to withstand concentrated flow;

- As construction proceeds, the site contours may change, and the barrier location and extent shall be re-evaluated by the Contractor to ensure its effectiveness; and
- Various styles of sediment barriers, and the correct installation techniques, are shown in Appendix C and the *Standard Specifications*.

Maintenance

(a) The barrier shall be inspected after each rainfall and at least daily during prolonged rainfall. Silt fences installed near watercourses must be inspected daily. Any deterioration or damage is to be repaired immediately, or operations ceased until repairs are complete;

(b) All barriers or parts of barriers that have been damaged shall be repaired immediately;

(c) If barriers are removed or opened to allow equipment to pass, the barrier must be replaced immediately;

(d) If significant volumes of silt (one half the height of the barrier or a depth of 300 mm immediately upstream of the control device) have accumulated against the barrier fence at any location, the silt shall be removed from the barrier or a second line of barrier installed;

(e) Fine colloidal clays may pass through sediment barriers. If this condition is encountered, special ESC techniques may be necessary, *e.g.* settlement ponds treated with flocculants to promote settling; and

(f) The barriers shall be removed to the satisfaction of the Project Engineer when areas upstream of the measure have been stabilized or, in the Project Engineer's opinion, they are no longer required. The area of the removed fence and any exposed sediment removed from the fence shall be dressed, seeded and mulched in accordance with this EPP, the *Standard Specification*, and any Special Provisions to the tender documents.

3.6.4 Diversion Ditches

Diversion ditches are used to intercept surface runoff and direct it to a collection or discharge point.

Location

- Diversion ditches shall be constructed along the top of cut areas, where the direction of the slope is toward the cut section. Typically, the top of slope ditches would transfer water to riprap down drains and then to the road ditch, or toe of slope ditch;
- Ditches shall also be placed at the base of grubbings disposal areas where the direction of slope is toward the highway; and
- Ditches can also be used to divert concentrated flow to sheet flow over vegetated areas.

Construction

(a) Diversion ditches shall be installed prior to grubbing to intercept surface runoff and divert water away from the slopes being constructed;

(b) Ditch dimensions shall be based on anticipated flows. As a minimum, diversion ditches shall be 300 mm deep with 3:1 side slopes;

(c) The ditch shall be lined with erosion control blanket for grades from 0% - 5% and with Clear Stone for grades over 5%. In ditches where velocities in excess of 3 m/s are anticipated, stone riprap size shall follow item C16 of the *NS Watercourse Alteration Specifications*; and

(d) Where ditches have been installed on long slopes to redirect surface runoff, the ditches shall be constructed as permanent features.

3.7 Grading

Grading for the purposes of the EPP includes the excavating, transporting, disposing or placement of materials within the limits of the work. Grading includes rock and overburden cut and fills, ditch excavation, and sloping and shaping of embankments. It is during these operations, that result in the exposure of large areas of soils, that highway construction has the highest potential for erosion.

The most effective and widely used erosion control practices used to minimize erosion include: strict adherence to the Work Progression Schedule (Section 3.1), sediment barriers, flow checks, straw/hay/compost/bark mulch, or erosion control blankets.

3.7.1 Straw/Hay Bales

Location
Straw/hay bales are temporary measures used to filter sheet flow and low-flow rill runoff. They may be used on an as-required basis along the toe of fill slopes and as surface protection (*i.e.*, when dispersed on the ground surface). Bales are **not** to be used adjacent to watercourses (install Type 2 silt fence) **nor** across ditches as flow checks.

Construction
(a) Bales for sediment barriers shall be installed in accordance with the *Standard Specification* (Division 7, Section 1);
(b) Straw bales shall be installed perpendicular to the flow and keyed in (*i.e.*, placed in a trench measuring 750 mm wide by 150 mm deep);
(c) Bales shall be securely bound and anchored with steel pins or wooden stakes; and
(d) The remaining trench space shall then be backfilled and compacted to existing grade.

Maintenance
(a) Sediment behind the bales shall be removed when sediment has accumulated up to one half of the height of the bale;
(b) Bales shall be removed and replaced if they have deteriorated to the point where they are no longer effectively filtering runoff; and
(c) Bales shall be maintained until the area upstream of the bales has been vegetated. On removal, bale strings shall be cut and disposed of, and the straw distributed on the ground.

3.7.2 Flow Checks

Flow checks are designed to slow the velocity of water in ditches, thereby reducing its erosive power. Although, not the primary purpose, flow checks also provide limited sediment control by trapping sediment on the upstream side of the flow check.

Location
Flow checks shall be constructed with clear stone or sandbags across roadside drainage ditches throughout cut sections and adjacent to inlets and outlets of culverts, or as otherwise directed by the Project Engineer (see Table 4).

Table 4
Recommended Flow Check Construction

Ditch Grade	Flow	Flow Check Type
0-2%	Low	Clear Stone
2-5%	Medium	Sand bags, Clear Stone
5-8%	High	Clear Stone. Materials to be graded to ensure trapping of sediment

Note: Flow checks are not recommended from grades >8%. For grades >8%, the Contractor shall line the ditch with permanent turf reinforcing mats or Clear Stone.

Construction

(a) Flow checks shall be constructed in accordance with the *Standard Specification* (Division 7, Section 2);

(b) The ends of the flow check must be higher than the middle to allow water to flow over the centre and to prevent scouring of the foreslope and backslope;

(c) The low point of the flow check must be lower than the top of the sub-grade;

(d) In general, flow checks are to be installed along any new ditching of the highway including the median and at spacings to be determined by dividing 200 m by the ditch grade in percent (Table 5). In coarser soils, this spacing can be increased with the approval of the Project Engineer. Spacing can also be increased if the ditch is lined with erosion control blanket;

(e) Flow checks shall be installed during construction and again after ditches are brought to final grade;

(f) Flow checks shall be installed around each catch basin located in the highway median; and

(g) Typical construction techniques for flow checks are shown in Appendix C.

Table 5
Recommended Flow Check Spacing

Slope (%)	Distance between flow checks	
	m	ft
2	100	300
3	65	200
4	50	150
5	40	120
8	25	75

Maintenance

(a) Flow checks shall be monitored by the Contractor throughout the construction period and cleaned out after each storm or when they become half full of sediment. Flow checks shall be maintained until vegetative cover is established; and

(b) All flow checks must be removed when vegetation is established. When the flow checks are removed, they should not be excavated to bare ground, instead a 5-10 mm layer of gravel from the flow check shall be left to prevent erosion, or the flow check location can be seeded and covered with erosion control blanket.

3.8 Site Access

The following protection measures apply to all existing and new right-of-way site access roads. Specifications and protection measures for landowner access roads are detailed in Appendix E.

(a) The number and size of access roads to the right-of-way will be minimized. Where possible, existing roads will be used (logging and farm roads). Existing roads shall be upgraded to meet the demands of heavy equipment. Upgrading can include: frequent grading to promote drainage off the rock, the addition of rock to stabilize soft areas, or gravelling;

(b) Where new access roads are constructed, the roads shall be built 200 m at a time to minimize amount of exposed soil;

(c) Access road ditches are important to keep the roadbed dry and stable. Ditches are not to run directly into the watercourse. Where ROW permits, take-off ditches are to be constructed to direct the runoff to drain through natural vegetation before it reaches any watercourses;

(d) Natural land drainage must not be blocked by the construction or use of access roads. Culverts or temporary bridges will be required at low points where drainage crosses the road. Culvert installations will be in accordance with the *NS Watercourse Alteration Specifications* (1997); and

(e) The Contractor shall maintain access roads to promote drainage off the road and to prevent deterioration of the road.

3.9 Winter Construction

Apart from clearing, winter construction is not normal practice for TPW. However, in certain circumstances such as wetland excavation, structure construction, or to avoid interactions with rare species during sensitive life stages, winter construction will reduce environmental impacts. Note however that winter construction is plagued by saturated soils, frozen ground, and variable success with soil stabilization measures and other ESC methods.

Protection Measures

(a) Prior to initiating winter works, all ESC measures that can be installed, shall be installed;

(b) If a delay is anticipated in finishing slopes, all exposed areas shall be covered with mulch in accordance with the *Standard Specification* (and/or Special Provisions). If the slopes are finished, they shall be covered with an erosion control blanket that can be seeded through in the spring. Alternatively, slopes can be sprayed with a bonded-fibre matrix product such as Soil Guard®. Slopes adjacent to watercourses, wetlands or other sensitive areas shall be covered with Clear Stone. Slopes shall be protected within one day of finishing;

(c) Straw/hay bales and sediment ponds will not be appropriate in frozen conditions, therefore the contractor shall use sediment fences, sediment control berms, and diversion ditches to intercept and direct water to adjacent vegetated areas;

(d) Buffer zones adjacent to watercourses, wetlands, and sensitive areas shall not be disturbed except to access temporary crossings (see section 3.2.4) unless otherwise approved by DFO and NSEL;

(e) Exposed subgrade shall be gravelled or roller compacted. Traffic on the subgrade shall be avoided if practical. If travel is required, it shall be limited to a single travelway; and

(f) Prior to winter shutdown, the Contractor shall have stockpiles of ESC materials on-hand, ready to mobilize to the Project site in the case of failure of ESC measures (*e.g.*, straw/hay bales, compost/bark mulch, Clear Stone, geotextile, stakes, plastic sheeting and tarps, and sediment control fence [Types I and II]).

3.10 Stabilization

Stabilization includes those measures applied to finished slopes and ditches as part of permanent erosion protection. These measures include: surface roughening; straw/hay, compost, bark mulch, erosion control blanket, Clear Stone, hydroseeding, and sod. Stabilization will be undertaken in a timely manner, as per the Work Progression Schedule.

3.10.1 Surface Preparation

Surface preparation shall include (a) removal of all deleterious materials such as sticks, roots or large rocks, (b) loosening of the top 50 mm of soil, and (c) scarification to minimize runoff velocities and to hold seed. Scarification shall be parallel to the contours of the slope with a minimum indentation (high to low) of 25 mm and a maximum spacing of 150 mm. Surface preparation can be used as a short term measure in conjunction with mulch and it shall be carried out to prepare slopes prior to placement of erosion control blanket or hydroseeding.

3.10.2 Straw/Hay, Compost and Bark Mulch

Mulch shall be applied as surface protection on slopes and other exposed ground to prevent erosion. It shall be used as a temporary protection measure for any area with erodible soil, or to protect areas that are built to final grade and a delay in hydroseeding is anticipated.

Locations

- Areas of exposed soil that do not require erosion control blanket; and
- Used as temporary slope protection until slopes can be finished and hydroseeded.

Construction

- Mulch shall be applied in accordance with the *Standard Specification* (Division 7, Section 6) and Special Provisions to the tender;
- Mulch shall be compost, bark, hay or straw, free of noxious weeds and other undesirable material, and not so wet, decayed or compacted so as to inhibit even and uniform spreading. The Contractor shall be responsible for confirming that the straw is free of noxious or invasive weeds;

- Mulch applied between May 1st and September 1st may or may not require binder. All mulching after September 1st and before May 1st shall require binder. Binder (tackifier) shall be applied at the manufacturer's recommended application rate;
- All slopes to be stabilized after September 1st shall utilize mulch and binder within 48 hours following the application of the hydroseed mix; and
- Rough ground and steep slopes require more mulch and binder per hectare than finished and/or flatter ground. Therefore, the Contractor shall adjust application rates within the allowable tolerance to ensure that the ground is covered with mulch as required.

Maintenance

Mulched areas shall be monitored frequently and additional mulch shall be applied to any bare areas observed.

3.10.3 Clear Stone

Clear Stone (Type C1) is used to ensure rapid and permanent stabilization of slopes, ditches and drains. Clear Stone is also required in the construction of culvert inlets, outlets, and energy dissipation (plunge) pools (see typical details in Appendix C).

Locations

- On the immediate embankment slopes at all culvert extensions to the lines and grades shown on the CMPs;
- Liner for ditches in erodible soils, or with slopes >5%;
- Permanent slope drains as indicated in the ECPs for various segments of the Project, or as required to prevent erosion from spring drainage;
- The outlet of culverts and ditches and in plunge pools and reconstructed stream channels in fish-bearing watercourses;
- Energy dissipation aprons at the outlet of diversion ditches;
- Fill slopes as shown in ECPs or as directed by the Project Engineer to prevent erosion;
- Placing of Clear Stone on embankment slopes shall be done concurrently with the placement of fill. Under no circumstances shall the height of the exposed surface exceed 2 m or a delay in the placement of Clear Stone exceed three days; and
- In other environmentally sensitive areas as directed by the Project Engineer.

3.10.4 Hydroseeding

Hydroseeding consists of applying a mixture of seed, fertilizer, mulch, binder, and water on foreslopes, median, backslopes, ditches and other prepared areas, to produce a uniform cover of grasses.

Locations

All exposed slopes, ditches, medians and disposal areas.

Construction

(a) The seed mix (percentage by mass) shall consist of:
40% Creeping Red Fescue
15% Timothy
15% Tall Fescue

10% Kentucky Blue Grass
10% Alsike Clover
5% Red Top
5% Perennial Rye

(b) Hydroseeding shall not be permitted on hardened or crusted soil. Hydroseeding shall be carried out as soon as possible after the completion of the surface preparation;

(c) If seeding is to take place after October 1, 10% oats shall be added to the mix to provide a quick growing, stable root mass;

(d) Each species shall meet or exceed the Canadian Grade Standards for Common No. 1 Seed. The Contractor shall provide the Project Engineer with seed certificates to confirm this requirement has been met;

(e) Fertilizer shall be 15-25-15 for seeding done May 1st to Sept. 1st, and 10-20-20 thereafter;

(f) Mulch shall be shredded newsprint (cellulose) coloured green with environmentally acceptable dye. Mulch shall contain no growth-inhibiting chemicals or compounds;

(g) Binder (tackifier) may be supplied in liquid or powder form and shall be applied at the Manufacturer's recommended application rate;

(h) Water shall be free of any impurities which would inhibit germination of grasses;

(i) Hydroseeding shall be carried out as soon as possible after completion of the surface preparation. Final dressing of slopes and other exposed soil shall be done as areas are completed, to enable hydroseeding to be done in stages as work progresses;

(j) Prior to hydroseeding, the surface of slopes shall be prepared by creating horizontal grooves that run parallel to the slope using tracked equipment;

(j) Hydroseeding shall not be performed under windy conditions or during periods of rainfall, in standing water, or under other adverse conditions; and

(k) Application rates shall be as follows:

Hydroseeding 'A' (May 1 to September 1)	
Seed	100 kg/ha
Fertilizer	625 kg/ha
Mulch (paper)	1350 kg/ha
Hydroseeding 'B' (after September 1)	
Seed	100 kg/ha
Fertilizer	625 kg/ha
Mulch (paper)	350 kg/ha

Notes: These rates may vary by ±10% depending on ground conditions, and at the discretion of the Project Engineer.

3.10.5 Erosion Control Blanket

Erosion control blankets are applied to finished slopes, ditches and swales to keep seed in place until vegetation is established. Erosion control blankets are to be used to protect slopes, ditches and swales immediately after they are shaped.

The three main benefits of erosion control blankets are that they:

- prevent seed from washing away; reduce energy of rain;
- minimize erosion; and
- keep the soil under the blanket moist.

While serving the same role as mulch, erosion control blankets have the added benefit that they will remain intact in high wind or heavy rain events provided they are installed as per the manufacturers instructions.

Five types of erosion control blanket are currently acceptable to TPW: jute, excelsior, wood fibre, straw, and polypropylene. The Contractor may employ other blanket types or spray-on applications such as Soil Guard® with the approval of the Project Engineer.

Locations

- Areas of culvert installation and extensions as shown in CMPs and ECPs;
- Slopes;
- Ditch bottoms; and
- Swales.

Construction

(a) Prior to the placement of the blankets, the area shall have lime, fertilizer and seed placed as per the *Standard Specification* (Division 7, Section 5);
(b) The erosion control blanket shall be installed in accordance with the manufacturer's recommendations and the *Standard Specification* (Division 7, Section 7);
(c) In each area designated for seeding and erosion control blanket, the soil surface shall be prepared not more than 7 days before the seeding and erosion control blanket are installed;
(d) Prior to placement of seed and erosion control blanket, the surface of slopes shall be prepared by creating horizontal grooves that run parallel to the slope using tracked equipment; and
(e) If a delay is anticipated between slope finishing and hydroseeding on slopes requiring erosion control blanket, the Contractor shall install erosion control blanket that can be seeded through to protect the finished slope from erosion until it can be seeded.

Maintenance

The Contractor is responsible for the maintenance of the erosion control blanket until a vegetative cover is established or the completion of the Contract.

3.10.6 Sod

Sod shall be used at locations adjacent to environmentally sensitive areas when immediate stabilization is required to prevent impacts from erosion and sedimentation.

Construction

(a) The Contractor shall rake the slopes to remove large rocks and roots;
(b) Topsoil must be placed prior to sod. A minimum of 75 mm of topsoil shall be placed and uniformly spread;
(c) Lime and fertilizer shall be spread on the topsoil as per Division 7, Section 13 of the *Standard Specification*; and
(d) Sod shall be laid and tamped to a uniform and even surface.

Maintenance

Sod shall be watered twice a day for seven days after laying, and then once a day for the next 14 days (as required, given the weather conditions).

3.11 Borrow and Gravel Pits and Quarries

(a) Locations will be approved by TPW. The Contractor shall adhere to the setback requirements stipulated in NSEL's *Pit and Quarry Guidelines*. All borrow pits and quarries shall be constructed, operated and rehabilitated in accordance with NSEL guidelines;
(b) An ESC Plan for the borrow pit shall be developed by the Contractor for review and approval by the Project Engineer (TPW has a new "Special Provision" that will form the basis for this activity; see Appendix A);
(c) All topsoil removed to access the pit or exposed rock for blasting shall be stockpiled on site for the eventual rehabilitation of the pit. The stockpile shall be seeded to minimize erosion and a sediment barrier shall be installed to contain sedimentation;
(d) Stormwater runoff from the site shall be controlled using the applicable measures described in Section 3.7 so that TSS concentrations in discharges from the site do not exceed 25 mg/L;
(e) All borrow material, gravel pit or quarry aggregates shall be approved by the Project Engineer or NSEL with respect to their acid production/consumption properties and concentration of heavy metals. If an acid production/consumption test is required, the test shall be carried out using the BC Research Test method; and
(f) Sites shall be rehabilitated in accordance with the *Standard Specification* (Division 1, Section 4), the *Pit and Quarry Guidelines,* and this EPP to ensure slope stability and to minimize erosion in the long term.

3.12 Dust Control

The Contractor shall implement dust control measures as required by the Project Engineer. Only water shall be used for dust control. The use of chemicals for dust control is prohibited unless approved by the Project Engineer.

Additional dust control measures will include:
(a) clean-up of mud and dust from paved roads and access points;
(b) establishment of spoil and construction material stockpiles in areas least prone to impact from prevailing winds from the southwest;
(c) cessation of dust generating construction activities during periods of excessive winds; and
(d) timely stabilization of exposed areas prone to wind erosion.

Further advice is provided in a new Environment Canada guideline "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities (March 2005).

3.13 Noise

Noise complaints are occasionally received by NSEL and TPW staff, especially during periods of construction. The only regulatory requirements for noise control are embodied in municipal by-laws, and these are primarily for construction and nuisance noise. Consequently, TPW and its contractors will abide by all municipal requirements, or where exempt, the spirit and intent of any noise by-law.

In order to protect the acoustic environment and residents' rights to 'peace, comfort and tranquillity', TPW and its contractors will make every effort to carry out the work in a manner which causes minimum inconvenience to landowners. This commitment will include the implementation of the following 'source, path and receptor control measures' during construction periods:

(a) TPW will notify local residents one week prior to impending construction through newspaper advertisements and electronic postings to the "Highways" page of the TPW website: http://www.gov.ns.ca/tran/highwayops/highwaymain.asp. The notice will contain a telephone number for the reporting of noise complaints;

(b) TPW's Contractor shall maintain, where practical, treed buffer zones along the ROW;

(c) In residential areas, the Contractor shall utilize enclosures around stationary equipment, whenever possible, to reduce noise emission (*e.g.*, power generators);

(d) When construction is planned within 30 m of a home, the Contractor shall schedule construction between 0700 and 2000, Monday to Friday, and 0800 to 1900 on weekends and holidays. Exceptions to this schedule shall be short-term, construction activities that must occur during night-time hours because of construction quality, traffic control and safety concerns (*e.g.*, concrete deck pours, paving, demolition of existing structures), or in specific circumstances when local residents have approved night construction;

(e) The Contractor shall use vehicles and equipment equipped with efficient muffling devices;

(f) The Contractor shall maintain equipment in good working order to minimize noise levels;

(g) The Contractor shall keep idling of construction equipment to a minimum;

(h) Within logistical constraints, the Contractor shall place material storage areas away from noise sensitive locations (residential areas with homes less than 30 m from the storage area);

(i) The Contractor shall conduct noise monitoring at representative residential locations during periods of intense construction activities (as defined by the Project Engineer and based on the Work Progression Schedule) to ensure noise levels are within 15 dBA (L_{eq} [2 hour]) of the average baseline levels (see Section 4.2.2 for further details). Many states in the United States use this level of exceedance to balance construction realities with residents' rights to peace and quiet (U.S. Department of Transportation, 2000). In the U.S., as in most jurisdictions in Canada, there is no mandated definition (or maximum permissible level) that constitutes a "substantial" increase over existing (ambient) noise levels.

(j) In cases of excess noise at the monitoring sites, the Contractor shall either re-schedule construction activities, or restrict intense noisy activities to the hours of 1000 to 1700.

3.14 Petroleum, Oil, Lubricant (POL) and Chemical Handling and Storage

All necessary precautions to prevent and minimize the spillage, misplacement or loss of fuels and other hazardous materials shall be taken. All Acts and Regulations pertaining to special substances shall be followed. The delivery, storage, use and disposal of these hazardous materials will be handled only by trained personnel in accordance with government laws and regulations. In the event of a spill, follow the procedures detailed in Appendix F.

The following precautions will be taken:

(a) Equipment used will be mechanically sound with no oil or gas leaks. The Contractor shall undertake frequent inspection of equipment and repair leaks immediately;

(b) Fuelling, storage and servicing of vehicles and construction equipment is not allowed within 30 m of a watercourse, drainage ditch, areas with a high water table, or exposed and shallow bedrock.

(c) Spill clean-up materials shall be accessible and maintained in the areas of fuel and chemical storage. Any spilled fuel or lubricants shall be promptly cleaned up and disposed of in accordance with NSEL instructions;

(d) No equipment shall be washed within 30 m of a watercourse or wetland;

(e) Storage of petroleum products is not allowed within boundaries for water supply watersheds or designated environmentally sensitive areas. Lubricants, hydraulic fluid, grease, gasoline, diesel or other fuels will not be stored within 30 m of any watercourse;

(f) All tanks shall be protected from collision damage by the use of snow fencing to alert operators, or by the placement of barriers to impede equipment movement near the tank;

(g) Handling and fuelling practices shall ensure that contamination of groundwater will not occur;

(h) Fuel storage areas and transfer lines shall be clearly marked or barricaded to prevent damage from vehicles;

(i) If drums are stored on their sides, the drums shall be stored so that the bungs are in the "9 and 3" position, on level ground and prevented from rolling;

(j) Drum storage areas shall be marked or fenced with temporary fence to avoid impacts;

(k) Day-use quantities can be stored upright or on the side as required. Drip pans lined with absorbent pads shall be used beneath taps;

(l) All stained soil resulting from the use of chemicals or fuels shall be cleaned-up and disposed of prior to leaving the work area; and

(m) Waste oils and lubricants will be retained in a closed container, and disposed of in an environmentally acceptable manner.

3.15 Waste Management

(a) Recyclable materials and materials banned from landfills (paper, cardboard, drink containers, wood, scrap steel, paint, metal and tires) will be collected separately for recycling;

(b) There shall be no burning of wastes generated on the site;

(c) Domestic waste from site offices and camps including food waste shall be gathered daily and stored in closed steel containers for removal and disposal at an approved waste disposal site;

(d) Non-recyclable non-hazardous construction wastes shall be removed from site on an as required basis for disposal at an approved waste disposal site;

(e) Rags used in equipment maintenance and other potentially combustible materials will be kept in a container separate from the above materials until the combustible material can be removed from site for disposal;

(f) Waste oils and lubricants will be stored in a labelled tank or drum and disposed of a disposal facility approved for receiving liquid industrial wastes; and

(g) Solvents, acids and caustic liquid waste will be collected separately and stored for removal and disposed by a waste management company specializing in liquid and hazardous wastes.

3.16 Concrete Batch Plants

This item details additional protection measures applicable to batch plants if employed on a project.

(a) Batch plants for concrete production shall be located away from residential areas and a minimum of 30 m from watercourses, wetlands and other environmentally sensitive areas;
(b) To control runoff from aggregate stockpiles and accumulated cement dust, sediment barriers in combination with perimeter ditching and settlement ponds shall be used to ensure effective sediment control;
(c) To control dust and minimize airborne particulate, water and/or calcium chloride shall be applied to the batch plant area and haul roads;
(d) Trucks shall be washed out into an area that drains to the settlement pond described above or to a settlement pond constructed for that purpose to ensure that TSS levels in discharges from the site do not exceed 25 mg/L;
(e) Care will be taken to ensure runoff pH and other characteristics from ponds and embankment fills are not deleterious to the aquatic environment (*i.e.*, pH between 6.5 and 9.0 and acceptable levels for metals noted in the *Canadian Water Quality Guidelines for the Protection of Aquatic Life*; see http://www.ccme.ca/initiatives/water.html?category_id=41). Note that filtering concrete wash-water or putting it in a settlement pond will not treat the high pH (may yield values of 12.0). Active treatment or off-site processing will be required. Contact the Project Engineer if pH of settlement pond water exceeds 9.0; and
(f) Waste Portland cement concrete can be disposed of in embankment fills with the approval of the Project Engineer.

3.17 Asphalt Plants

All temporary plants employed on a project shall be approved by NSEL. The Contractor shall provide a copy of the approval to the Project Engineer prior to mobilizing the plant to site. The following additional protection measures apply to asphalt plants.

(a) Chemicals associated with the plant shall be stored, handled and disposed of in accordance with Sections 3.15 and 3.16;
(b) Plants shall utilize best available techniques for reducing/minimizing air emissions (see www.ccme.ca/assets/pdf/hot_mix_asphalt_final_meraf_e.pdf);
(c) Settlement ponds if used shall be lined to prevent infiltration. Water shall not be discharged to the environment without testing for suspended solids and total petroleum hydrocarbons. Water shall not be discharged if TSS levels are greater than 25 mg/L or total petroleum hydrocarbons are greater than 15 mg/L;
(d) Care will be taken to ensure run off pH and other characteristics from ponds and embankment fills are not deleterious to the aquatic environment;
(e) Storage tanks containing oil or fuel shall be dyked, or protected, in accordance with NSEL *Petroleum Storage Regulations*;
(f) Tanks shall be located or protected to minimize the potential for collision; and
(g) Waste or excess asphalt may be disposed in embankment fills with the approval of the Project Engineer.

3.18 Road Salt Management Plan

Since a federal environmental assessment on road salt concluded that road salts are "toxic" to the environment, as defined under the *Canadian Environmental Protection Act*, federal and provincial governments are currently developing management instruments to reduce the impacts of road salts on the environment. TPW has taken a pro-active approach to better manage the use of road salts, including:

1. Construction of 22 new salt/sand storage sheds in various locations around the province, and plans for five more in 2005. The new sheds were primarily built to increase the amount of salt/sand mixture storage, as the majority of our road salt is already stored indoors;

2. The installation of 33 "Road Weather Information Systems" (RWIS) and associated highway camera systems (see http://www.gov.ns.ca/tran/webcam/HighwayCameras.stm);

3. In 2001, TPW implemented new winter maintenance standards that require highway crews to provide consistent and measurable ice and snow removal to all areas of Nova Scotia;

4. Conduct of pre-wetting trials near the RWIS sites to reduce the loss of road salts applied to highways due to wind and traffic disturbance. Results to-date indicate savings of up to 10-12% with the same level of service. Further reductions in road salts can be realized if placed just prior to a storm event. This process is usually referred to as "anti-icing" as opposed to "de-icing";

5. TPW has upgraded its entire salt-spreading truck fleet through the installation of computerized (*Compuspread*) salt controls; and

6. TPW has completed its *Salt Management Plan (*SMP; June 2004) to more effectively manage salt usage across the Province and meet the commitments that were previously made to Environment Canada. The three-volume SMP contains detailed information about TPW policy, key responsibilities of various TPW staff, SMP implementation, monitoring and reporting, current winter maintenance practices, salt storage and handling, salt application, salt vulnerable areas, training, and best management practices (BMPs). A digital copy of the Plan is available on TPW's website: *http://iweb.tpw.gov.ns.ca/department/govpublication.asp*

7. In the fall of 2004, TPW started the implementation of the SMP, well ahead of the Environment Canada milestone dates.

4.0 MONITORING AND INSPECTION

There are two general types of monitoring which are considered in determining the environmental impact of activities and the effectiveness of mitigation measures: environmental compliance monitoring (ECM) and environmental effects monitoring (EEM). Compliance monitoring assesses adherence to environmental regulations. Effects monitoring assesses the accuracy of predictions and the effectiveness of proposed mitigation measures.

ECM and EEM programs will be implemented by TPW to ensure that pre-construction commitments are fulfilled; that the highway is built and maintained to the satisfaction of all stakeholders, including regulatory authorities; and that public health, safety, and the environment are protected during the operation and maintenance of the highway.

4.1 Environmental Compliance Monitoring

ECM can be divided into two distinct elements:

- regulatory environmental surveillance; and
- self-regulatory monitoring and inspection.

The component of ECM carried out by regulatory authorities consists of monitoring to verify compliance with applicable legislation and conditions of regulatory authorizations issued in respect of a Project. This monitoring will be carried out by: NSEL, DNR, DFO, Environment Canada and Transport Canada, as appropriate.

The remaining materials in this section deal specifically with self-regulatory monitoring and inspection activities.

Self-regulatory ECM is that which a proponent undertakes to monitor its own activities against internal commitments, such as those contained in the Conditions of Release/Approval, the Project EPP and ECPs/CMPs, and external environmental standards (*i.e.*, legislation and authorizations). Self-regulatory ECM will involve:

- monitoring of environmentally-sensitive activities by the Contractor and TPW to ensure compliance with applicable laws and regulations, and permits issued in respect of the Project;
- monitoring of environmentally-sensitive activities by the Contractor and TPW to ensure compliance with internal (*i.e.*, EPP/ECP commitments) and external non-regulatory environmental standards;
- coordination and communication with regulatory authorities, and the Public, as required;
- assistance with EEM studies and other environmental programs associated with the Project (see Section 4.2); and
- provision of on-site environmental advice to Project personnel.

The prime vehicles for ECM will be the regulators' Conditions of Release/Approval, the EPP, and permits, authorizations, and letters of advice issued by NSEL and DFO for construction and operation activities (and any other regulatory agencies).

The ECM program will be implemented by carrying out environmental monitoring and inspection, including:

- ensuring compliance with all applicable government acts, regulations, and permits issued in respect of the Project;
- ensuring that the environmental commitments are met; and
- ensuring that established environmental policies, standards and procedures are followed by the Contractor.

The ECM program will ensure that pre-construction commitments made to regulatory agencies and other stakeholder groups are fulfilled during construction and that preventative and protective environmental measures are in place and functioning properly throughout construction. TPW will also conduct periodic inspection of the implementation of habitat compensation/creation measures identified in any compensation proposals for 'harmful alteration, disruption or destruction of fish habitat' (HADD).

Environmental inspection of ESC measures and project activities is essential to ensure the effectiveness of measures taken by the Contractor to protect the environment.

The Contractor shall, as a minimum, carry out daily environmental inspections of the site. For more sensitive aspects of the work, such as culvert installation, inspection shall be carried out at critical times in the process (*e.g.*, storm-weather periods, watercourse diversion, excavation, construction of inlet and outlet channels, and removal of temporary diversions). All ESC measures shall be inspected during and immediately following significant rainfall and snow-melt events. Inspection and monitoring will also be carried out by the Project Engineer and staff from TPW's Environmental Services Section to verify the Contractor's performance.

The following summarizes the items requiring inspection. The Contractor's Environmental Monitor, Project Engineer and TPW Inspectors shall use the Generic EPP, Project EPP, ECPs, CMPs, the *Standard Specification*, and Special Provisions to the tender documents as references for the inspections. An inspection checklist for use during construction is provided in Appendix G. Incident Report Forms are also included here to document significant non-compliance issues, spills and 'near misses'.

(a) Grubbing activities and disposal areas shall be examined for evidence of erosion, siltation, or potential for erosion and siltation. Work close to watercourses shall be monitored closely.
(b) All ESC measures are to be inspected to ensure they have been installed in a location where they are effective.
(c) Inspect site daily to observe installation and maintenance of ESC measures.
(d) Examine sediment control fence, flow checks, and sediment ponds, and ensure they are maintained properly.
(e) Examine diversion ditches to ensure they are installed according to the *Standard Specification* and the EPP/ECPs/CMPs. Examine ditch outlet for any signs of erosion. Diversion ditches shall be in place prior to the excavation of cuts.
(f) Mulch shall have adequate coverage and shall be applied promptly to exposed areas.

(g) Hydroseeding shall have adequate coverage and must be seeded as areas are brought to final grade. Obtain seed certificates to confirm specified seed is being applied.

(h) Determine if erosion control blanket is installed as per manufacturer's instructions and whether the blanket requires repairs.

(i) Review waste management and hazardous material storage to ensure compliance with regulations and this EPP.

(j) Determine if site access and landowner access roads are constructed and maintained in accordance with the EPP.

(k) Monitor dust conditions on site and note whether Contractor has taken action to control dust if it is a concern.

(l) Note de-watering operations, especially at culvert or structure abutment sites. Note location and discharge method or filtering method being used.

(m) Note compliance with steps detailed in ECPs and CMPs for culvert installation and structure abutment excavation and construction.

(n) Note the extent of stained soil observed and its location. If possible, identify the source so that equipment repairs can be made.

(o) Note any water samples collected (location, time, analyses required and rationale).

(p) The inspection shall also include any additional observations related to environmental protection matters.

(q) If deficiencies are noted, the Project Engineer, or designate, shall detail the incidents and manner in which to address them. Where possible, this shall be done as a cooperative effort with the Contractor.

(r) As appropriate, the Project Engineer will also prepare Incident Report Forms for significant non-compliance issues, spills and 'near-misses' and submit them to the Contractor's Construction Supervisor, the Environmental Services Section, and relevant government regulators/inspectors as required by NSEL/DFO approvals and authorizations (forms are provided in Appendix G).

4.2 Environmental Effects Monitoring

EEM is conducted to validate impact predictions, and to evaluate the effectiveness of and identify the need to alter or improve mitigative measures. An EEM program normally involves the collection of repetitive measurements of environmental variables to detect changes caused by external influences directly or indirectly attributable to a specific human activity or development. For federally-funded projects, the need for an EEM program is determined by the responsible authority (RA) and is based upon criteria listed in the *Canadian Environmental Assessment Act* Responsible Authority's Guide (1994). The guide states that follow-up programs are needed in a case of uncertainty or unfamiliarity in either the analysis and predictions of the environmental assessment or in mitigative measures. Follow-up programs may be needed in a case where:

- the project involves new or unproven technology or mitigative measures;
- an otherwise familiar or routine project is proposed for a new or unfamiliar setting;
- the assessment analysis was based on new technique or model (or uncertainty about conclusions); or
- environmental effects could change due to a project scheduling change.

TPW is committed to completing both general EEM and ECM activities for air quality, noise, water supplies, and total suspended sediments (TSS). The programs described below are those which will be included in the Contractor's and TPW's environmental monitoring programs.

4.2.1 Air Quality

The Contractor shall monitor the operation of Contractor-controlled equipment used during the construction phase to ensure it is in good operating condition.

The Contractor is also encouraged to (a) establish non-idling policies for all construction equipment and trucks in order to improve local air quality and reduce greenhouse gas (GHG) emissions, and (b) investigate the use of "biodiesel" whenever possible to further help reduce GHG emissions (contact Marc Sheeran, Environment Canada - Climate Change Division, 902-426-1401).

Dust will be monitored visually both by the Contractor and by the Project Engineer. Dust monitoring according to NSEL and EC guidelines (high-volume sampling of TSP) may be undertaken to address dust complaints. If required, the Project Engineer will provide advice concerning dust control methods.

4.2.2 Noise

Where intensive construction activities are scheduled within 30 m of residential areas, noise shall be monitored by the Contractor in accordance with NSEL's *Guideline for Environmental Noise and Assessment* (1991). As indicated in Section 3.13, the Contractor shall either reschedule construction activities or restrict intense activities to the hours of 1000 to 1700 when noise levels (defined as L_{eq} [2 hours]) exceed pre-construction baseline levels by 15 dBA. Baseline levels shall be those collected as part of the environmental impact assessment process, or new data collected prior to construction when the existing data for daytime, evening and night-time periods are believed to be no longer representative.

Given the variability in ambient noise levels at various sampling locations, the highest average values for daytime and evening periods within a construction 'work area' shall be deemed the base for determining the maximum exceedence value. The Project Engineer will identify appropriate sampling locations for baseline studies and construction monitoring, and ensure resident/landowner notification of impending monitoring surveys. TPW will provide a copy of the preconstruction baseline study to the Contractor to ensure data consistency.

If noise levels are in excess of maximum exceedance levels for a specific work area, the Contractor will immediately cease operations, compare the levels to the Threshold Limit Values (TLVs) published by the NS Workers Compensation Board (http://www.wcb.ns.ca/policymanual/pminoise.html) to ensure compliance with exposure limits, and either reschedule construction activities or restrict noisy operations to the hours of 1000 to 1700. The Contractor shall also immediately inform the Project Engineer of the situation and subsequent actions.

4.2.3 Water Supplies

TPW will carry out a detailed survey of potential water supplies (wells) within 300 m of the centreline prior to the start of construction (*i.e.*, 600 m corridor width). This information will provide the baseline for future comparisons of water quality and quantity. The survey database will include the type of water supply, its condition, and production rate. Water samples will be obtained from the kitchen tap and analysed for pH, general chemistry and metals, as well as fecal and total coliform counts as per guidelines for sampling domestic wells. Water samples must be analysed immediately following collection and shall not be frozen for future analysis. All results shall be directed to the Project Engineer. Should any samples indicate fecal coliforms, or concentrations of other parameters in excess of *Drinking Water Standards*, the Project Engineer will immediately notify the landowners.

In the event that blasting is required, additional pre-blast and post-blast surveys of wells will be conducted by the contractor. Monitoring of blasts will be conducted according to municipal by-laws and DFO guidelines and authorizations (Wright and Hopky 1998), and may include measurements of air concussion, ground vibration, and wellwater quality and quantity.

4.2.4 Total Suspended Sediments

The Contractor shall be responsible for the collection of TSS samples from selected watercourses on an event-basis to monitor the efficacy of ESC measures. These events will be defined as storms that are predicted to deliver more than 10 mm of rain or equivalent in snowmelt to areas that have exposed soils (note that soils should be protected at non-active construction sites). The purpose of this monitoring program is to identify areas that require additional protective measures (see also comments on Inspection and Maintenance in the TPW's Standard Specification, Division 1, Section 5, Item 8.0).

All data shall be submitted to the Project Engineer and the Environmental Services Section for further consideration and action (implementation of additional ESC measures). TPW will conduct a number of independent surveys to verify the Contractors results and observations.

Sampling stations will be located within 100 m of the ROW, or the construction activity/point of water discharge, and marked to enable future return to the same upstream and downstream locations. In general, sampling will be initiated at downstream locations 30-60 minutes after the onset of rain to establish baseline conditions (for events that are predicted to start after working hours, collect the first [baseline] sample at the end of the working day). Upstream samples will then be collected. Subsequent samples, at upstream and downstream locations, should be collected as follows:

Sample	Morning Onset of Rain	Afternoon Onset of Rain	Overnight Onset
#1	+30 to 60 minutes	+30 to 60 minutes	End of working day
#2	+6 hours	End of working day	Start of next work-day
#3	End of working day	Start of next work day	Mid-day
#4	Start of next work day	Mid-day	End of working day
#5	Mid-day	End of working day	Start of next day

Previous studies conducted for TPW by Dalhousie University-Centre for Water Resource Studies (Scott and Waller, 2004) indicate the beginning of TSS response to storm runoff ranges from 1 to 18 hours with an average of 5 hours after the onset of rain. Peak TSS levels for storms that deliver more than 20 mm of rainfall occurred 7.5-24 hours after the start of the events.

The sampling and sample handling procedures shall be as follows:

- Use laboratory-supplied bottles and label with date, time, and sample location;
- Sample facing upstream to avoid collecting surface debris and sediment that may have been stirred up by gaining access to the watercourse. Collect water from mid-stream and at mid-depth, whenever possible (if safety is an issue, take a surface sample from as far out in the channel as the sampler can reach; sampler should wear hightop rubber boots if possible to further extend his/her reach; alternatively use a boat);
- Follow laboratory instructions regarding bottle filling. This may include rinsing the sample bottle three times with water to be sampled. Completely fill the bottle being careful not to collect any surface debris or stir up sediment;
- Place bottles upright in a cooler with ice or ice packs. Samples shall be kept chilled (on ice or in a 4°C refrigerator) until received by the analytical laboratory;
- Complete the laboratory-supplied Chain of Custody Form. Retain one copy and ship the cooler as soon as practical following sampling (must be within 4 days for TSS or the sampling day if a turbidity analysis is also required); and
- Prepare field notes to summarize weather conditions/predictions, rainfall amounts, sampling information (date, time, location), replicate samples (one triplicate set per event), and any other anecdotal information (*e.g.*, occurrence of sediment plumes [associated with construction, ATV trails, cattle, etc.], on-going construction activities, and time of apparent recovery of watercourse to background [upstream] conditions).

Following completion of sampling, the Environmental Monitor/Inspector shall visually inspect the ESC measures for signs of problems and note the nature of runoff water passing through/around the installations. Visual inspections shall also be carried out at the non-active construction sites to verify the performance of installed ESC measures. Photographs would be a useful addition to sampling notes. All field notes should be submitted to the Project Engineer with a copy to TPW's Environmental Services Section.

If runoff water is turbid, or problems seem imminent (or have occurred in the past), inform the Contractor's Supervisor and the Project Engineer to ensure remedial action is taken.

5.0 CONTINGENCY PLANS

5.1 Chemical and Fuel Spills

Federal and Provincial acts place the responsibility for spill prevention and mitigation on the owner or controller of products or materials that can be spilled. Spills are defined under these Acts, as, but not limited to:
- spills from containers including drums and tanks;
- spills resulting from breaks in hydraulic or transfer hoses or piping; and
- spills resulting from traffic accidents and fire fighting.

In accordance with these Acts, the Contractor has an obligation to:

- prevent, eliminate or remediate an adverse affect resulting from a spill; and
- report the spill to the Project Engineer and other applicable organizations as requested in NSEL and DFO Approvals, Authorizations, Terms and Conditions, and Letters of Advice.

The Contractor shall reduce the likelihood of spills by implementing effective spill prevention measures such as the careful handling and proper storage of the products in use.

In the event of a spill, the procedures detailed in Appendix F shall be followed to facilitate a quick response. The response plan is established to coordinate action with the local Environmental Response Group and TPW and NSEL emergency response teams.

5.2 Heritage Resources

In the event that a heritage or archaeological feature is encountered during construction, the following measures will be taken to protect the feature(s) from further damage:

(a) All work in the area of the encounter shall cease;
(b) The potential find shall be protected by erection of a snow fence and signed as off limits to construction personnel;
(c) The Contractor shall contact the Environmental Services Section (TPW - Tel: 424-4080, Fax: 424-0570), and the Provincial Archaeologist or Curator of Special Places (Nova Scotia Museum -Tel: 424-6475, Fax: 424-0560). TPW's Environmental Services Section will subsequently inform either the Confederation of Mainland Mi'kmaq (Michael Cox, Director of Lands, Environment & Natural Resources at 895-6385), or the Union of Nova Scotia Indians (Kim Paul, Environmental Technical Services at 539-4107); and
(d) Work at the site will not be recommence until permission to proceed has been granted by the Nova Scotia Museum.

In the event that human remains are encountered, work shall immediately stop, and the Police and Nova Scotia Museum shall be notified.

5.3 Contaminated Sites

In the event that buried debris or contaminated soil is encountered during highway construction, the following procedure shall be followed:

(e) On detection, cease excavation activity in the area of the discovery and contact the Project Engineer. Under no circumstances shall the material be excavated without authorization of the Project Engineer;

(f) The Project Engineer or a representative of TPW's Environmental Services Section will visually inspect the material to assess potential for hazardous materials;

(g) If hazardous materials are suspected, the Project Engineer shall obtain samples following safe sampling practices;

(h) Contaminated soil or debris containing regulated material, suspected asbestos containing material, or other hazardous materials, shall be covered until a management plan is developed and a contractor appropriately trained in the handling of hazardous materials is retained; and

(i) The Project Engineer shall consult with NSEL on the appropriate clean-up program and disposal requirements.

5.4 Acid Generating Bedrock

In the event that coal-bearing bedrock or bedrock of the Meguma Group (Halifax and Goldenville formations; slates, quartzite and greywacke) are exposed during construction, the Contractor will immediately contact the Project Engineer for advice on how to proceed. Samples will be required for subsequent testing of acid-generating potential. High levels will mandate NSEL, DFO and Environment Canada notification and the preparation of an ECP to treat/handle the materials in accordance with the "*Sulfide Bearing Material Disposal Regulations*." Some of the concerns and contingency plans are outlined below.

5.4.1 General Protection Measures

(a) The volume of sulfide bearing bedrock disturbed shall be minimized. It should be noted that the volume disturbed is contingent on the contingency plan approved by NSEL. The approved plan may increase the volume of rock disturbed over that which would be disturbed in typical rock excavation;

(b) The length of time the rock is exposed shall be less than 30 days unless a written request for additional time is approved by NSEL;

(c) Temporarily exposed slates shall be covered and newly exposed slate surfaces shall be sealed and stabilized using a method pre-approved by NSEL;

(d) Surface runoff leading to the disturbed bedrock shall be diverted away from the disturbed area;

(e) Runoff from the sulfide bearing bedrock shall be directed to centralized points before leaving the ROW. The runoff from the site shall be monitored for acidity and metals during and after construction in accordance with an approved ECP (to be developed in association with NSEL, DFO and EC). If treatment is required, the Project Engineer will direct the Contractor on treatment method to be employed; and

(f) Sulfide bearing bedrock shall not be used for construction purposes unless its use has been approved in writing by NSEL, but instead disposed of as soon as possible in accordance with the "Sulfide Bearing Material Disposal Regulations" of the Nova Scotia *Environment Act*. Note that disposal of material in excess of 500 m^3 *in situ* or 1300 tonnes requires an approval from the NSEL.

5.4.2 Drainage Control and Excavation Plans

(a) Measures to divert water away from or collect water draining through the excavation site shall be in place prior to excavation of the rock;

(b) Excavation shall first be attempted by digging and ripping prior to proceeding with blasting. Digging and ripping, if practical is the preferred excavation method;

(c) In blasting, maximize the blast rock size and minimize the amount of overbreak through the use of (1) nitroglycerin rather than emulsion explosives, (2) pre-shear blasting techniques, and/or (3) lower blasting charges per hole;

(d) The Contractor shall take all measures to minimize the excavation of rock beyond the required grading limits,

(e) Remove all exposed loose material to the greatest extent possible,

(f) The Contractor shall not proceed with placement of the low permeability cap until the surface has been approved by the Project Engineer,

(g) Excavation of blasted material shall be carried out within 10 days of blasting, and

(h) Rock shall be loaded and removed to the burial or disposal site as it is excavated.

5.4.3 Placement of Low Permeability Cap

(a) Cap material shall consist of site material or imported borrow that has a maximum particle size of 100 mm and greater than 30% passing an 80 micrometer sieve. The material shall have a permeability of less than 1×10^{-6} when compacted to 95% Standard Proctor maximum dry density;

(b) For each 500 m^3 of material used, the following tests are required. All results are to be submitted to the Project Engineer;

Grainsize	ASTM C136, C117
Natural Moisture Content	ASTM D2216
Standard Proctor	ASTM D698
Permeability	ASTM D5084
Atterburg Limits	ASTM D4318

(c) Exposed rock surfaces shall be covered within 10 days of being exposed and be completed within 30 days unless a written request for time extension is approved by NSEL and EC;

(d) The cap will have a minimum thickness of 1000 mm and each lift of material placed to achieve this thickness shall be compacted to at least 95% of Standard Proctor maximum dry density (*i.e.*, cap equivalent to a 1000 mm layer of 1×10^{-6}). The minimum cap thickness can potentially be reduced if the exposed bedrock is considered to be in a protected area (*e.g.*, the highway base). Since the area will be overlaid by additional gravel and pavement, a thinner cap may be allowed. The Contractor shall consult with the Project Engineer for further advice;

(e) The vibratory roller shall be drum driven to enable the roller to climb and compact on a 3H:1V slope and deliver a dynamic force of at least 70 kN;

(f) Each lift shall be tested for density using a Nuclear Densometer. Each lift shall be approved by the Project Engineer prior to placing the next lift;

(g) The cap shall be covered with 100 mm of topsoil and hydroseeded in accordance with TPW's *Standard Specification* and the ECP; and

(h) The cap for protected areas under the road shall be covered by geotextile and a minimum 300 mm layer of Type 2 gravel.

5.5 Failure of ESC Measures

Having a contingency plan and the resources for emergencies is the last of the TPW *Principles of Erosion and Sediment Control* (see Section 3.2). The Contractor shall provide an outline of an appropriate Contingency Plan to the Project Engineer and the Environmental Services Section. This plan shall deal with extreme or long duration rainfall events (during all construction seasons) and the failure of ESC measures, especially those in or near watercourses. Essential components of the plan shall include the following:

- Staff training (e.g., tailgate/toolbox safety and environmental meetings to inform/educate staff of potential problems and hazards; include list of personnel with *TPW Green Card*);
- Storm preparedness (conditions for work stoppages, pre-storm staff meetings, inspection of all ESC measures, preventative maintenance of ESC measures, cover applied to highly erodible areas, clean-out of settlement ponds and check dams, and proactive measures that the Contractor shall implement to ensure critical ESC measures at or in watercourses will withstand storm runoff and wind conditions);
- Confirmed availability of equipment and operators that can be mobilized on short notice to create/repair berms, dams, diversion ditches, settlement ponds and turbidity curtains;
- Stockpiles of ESC materials (include quantities and locations for strategic placements);
    - straw/hay bales, compost, and/or bark (to be used as mulch/cover material)
    - ESC blankets/matting and staples (or tarps/plastic sheeting)
    - Sandbags, clear stone
    - Water pumps, hoses and fuel (the latter to be stored in a 'safe' location)
    - Turbidity curtains
- Typical approaches for temporary control of water flow and erosion until new ESC measures can be implemented (*e.g.*, excavation of cross ditches to divert runoff away from waterbodies and into settlement ponds or vegetated areas, excavation of temporary water storage areas, berm construction, bank stabilization, and deployment of backup turbidity curtains). Note that approaches will vary depending upon season, and the Contractor shall indicate approaches for (a) summer, low flow periods, (b) spring-fall, high flow periods, and (c) frozen ground, high-flow periods;
- Standard protocols for notification of ESC failure to the Project Engineer, TPW's Environmental Services Section, and NSEL/DFO inspectors; and
- Incident and 'Near Miss' reporting to the Project Engineer and Environmental Services Section to provide documentation of ESC failure (a *Near Miss Report* details failures that did not result in the loss/release of sediment; the intention is identify the cause and help prevent future occurrences).

6.0 REFERENCES

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NOVA SCOTIA
Transportation and Public Works

APPENDIX A

SELECTED SPECIAL PROVISIONS

1.0 DESCRIPTION

This item shall consist of the supply and application of approved compost material as shown on the plans or as directed by the Project Engineer.

2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This specification makes reference to the following standards, specifications or publications:

- CCME "Guidelines for Compost Quality"
- NSDEL "Composting Facility Guidelines"
- Canada Fertilizers Act and Regulations
- TMECC: "Test Methods for the Examination of Composting and Compost"
- AASHTO Standard Specification: Compost for Erosion/Sediment Control (Compost Blankets); AASHTO Designation MP 10
- AASHTO Designation T 265-93 (2000) Laboratory Determination of Moisture Content of Soils
- AASHTO Designation T 267-86 (2000) Determination of Organic Content in Soils by Loss on Ignition

3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

Prior to delivery of compost to the site, the Contractor shall provide the Project Engineer with the following information:

- A list of the feedstock by percentage used in producing the compost material
- A certification statement verifying that the compost meets NSDEL requirements for Class A Compost
- A copy of the laboratory analysis for the compost material showing major plant nutrients, pH, CEC and mineral (metal) concentrations.
- A certification statement verifying that the compost material meets the physical requirements in Table 1.

The Project Engineer may require the Contractor to provide a sample of the compost for confirmatory purposes.

4.0 MATERIALS

The compost material shall be an organic substance produced from the aerobic decomposition of organic matter. The compost material shall not contain any visible refuse material nor any material toxic to plant establishment or growth. The composted material may be derived from, but not limited to, leaves, yard trimmings, food scraps, food processing residues, manure and other agricultural residues, bark and other forest residues, soiled or un-recycled paper and biosolids.

Compost materials shall meet all applicable provincial and federal regulations and guidelines for compost production. Compost material shall meet the time and temperature requirements to control pathogens, noxious weeds and rodent attraction. Compost material shall meet the CCME Classification for Category A. Category B may be used at the discretion of the Project Engineer and approval from NSDEL. Compost material shall meet the physical requirements shown in Table 1 or meet requirements designated by the Project Engineer.

Table 1

Compost for Manufactured Topsoil	**Erosion Control Compost**	**General Use Compost**
Organic Matter Content: 30% dry mass	Organic Matter Content: 40-60% dry mass	Organic Matter Content: 40-60% dry mass
Moisture Content: 40-60%	Moisture Content: 40-60%	Moisture Content: 40-60%
Particle Size: 100% passing 28 000 µm sieve	Particle Size: 100% passing 80 000 µm and <70% passing 25 000 µm sieve	Particle Size: 100% passing 20 000 µm and 70% passing 850 µm sieve
Soluble Salts: 5.0 max. dS/m	Soluble Salts: 5.0 max. dS/m	Soluble Salts: 5.0 max. dS/m
pH: 5.5 - 8.5	pH: 5.5 - 8.5	pH: 5.5 - 8.5

5.0 CONSTRUCTION METHODS

After the designated areas have been graded according to the lines and grades approved by the Project Engineer, compost of the specified type shall be placed according to the following descriptions. Compost materials shall be loose and friable and be free of dust at the time of application. No compost materials shall be stored on site within 30 m of a watercourse.

5.1 Compost Manufactured Topsoil. Compost manufactured topsoil shall consist of soil material amended with 10 - 30% compost by volume. The soil material shall be free from trash, stumps and other objectionable materials, and shall be approved by the Project Engineer, prior to beginning the mixing process.

5.1.1 Blended On Site. Compost shall be evenly spread in a uniform layer over the previously prepared slope and thoroughly mixed to the depths shown on the plans or as directed by the Project Engineer.

5.1.2 Pre-Blended. Topsoil manufactured off-site shall be spread over the prepared slope in a uniform layer to a depth of 10 -20 cm. The topsoil shall be free of objectionable materials.

5.2 Erosion Control Compost. Compost materials shall be spread evenly over the prepared subgrade or slopes to form a uniform layer of a thickness of 50 - 75 mm or as shown on the plans. Compost shall not be used for erosion control on slopes ➤ steeper than 2:1.

5.3 General Use Compost. General use compost shall be applied as a top dressing over established areas of turf, grass or other ground cover to the depth specified on the plans or as directed by the Project Engineer.

6.0 QUALITY CONTROL / QUALITY ASSURANCE

7.0 METHOD OF MEASUREMENT

Measurement for compost shall be the area in square metres where erosion control compost, general use compost, on-site blended compost, and manufactured topsoil has been acceptably applied and in place, measured along the slope of the ground.

8.0 BASIS OF PAYMENT

- Blended On-Site Compost
- Pre-Blended Compost
- Erosion Control Compost
- General Use Compost

Payment at the contract unit price for the above tender item(s) shall be full compensation for all labour, equipment and material necessary to perform the work.

Slope preparation prior to use of compost materials and removal of objectionable materials will not be measured for payment, but shall be considered as incidental to the bid items under which the excavation or embankment construction of such areas was carried out.

If hydroseeding is required, payment for hydroseeding will be made as per Division 7 Section 5.

9.0 WARRANTY

1.0 DESCRIPTION

This item shall consist of the supply and application of approved bark material as shown on the plans or as directed by the Project Engineer.

2.0 REFERENCES

- AASHTO Designation T 265-93 (2000) Laboratory Determination of Moisture Content of Soils
- AASHTO Designation T 267-86 (2000) Determination of Organic Content in Soils by Loss on Ignition

3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

4.0 MATERIALS

4.1 General. The bark (wood waste) material shall be derived from weed free bark and conform to the following requirements:
- pH: 4.0-8.5
- Particle size: 100% passing a 80 000 μm sieve and 50% passing a 28 000 μm sieve
- Organic matter: no less than 70% by dry weight basis
- Moisture content: less than 60%
- The material shall not contain any visible refuse material nor any material toxic to plant establishment or growth.

4.2 Documentation. Prior to delivery of bark mulch to the site, the Contractor shall provide the Project Engineer with certification that the bark material conforms to the above requirements. The Project Engineer may also request the Contractor to provide a sample of the compost for confirmatory testing purposes.

5.0 CONSTRUCTION METHODS

After the designated areas have been graded according to the lines and grades approved by the Project Engineer, the bark shall be spread evenly over the prepared slopes to a uniform thickness as follows:
- 50 - 75 mm on slopes ≤3:1,
- 75 - 100 mm on slopes between 3:1 and 2:1,
- or as shown on the tender drawings,
- or as directed by the Project Engineer.

Bark, for erosion control, shall not be used on slopes steeper than 2:1. Bark materials shall be loose and friable and be free of dust at the time of application. No bark materials shall be stored on site within 30 m of a watercourse.

6.0 QUALITY CONTROL / QUALITY ASSURANCE

7.0 METHOD OF MEASUREMENT

Measurement for bark material shall be the area in square metres where bark material has been acceptably applied and in place, measured along the slope of the ground.

8.0 BASIS OF PAYMENT

Payment for bark materials at the contract unit price shall be full compensation for all labour, equipment and material necessary to perform the work.

Slope preparation prior to the placement of bark materials and the removal of objectionable materials will not be measured for payment, but shall be considered as incidental to the bid items under which the excavation or embankment construction of such areas was carried out.

If hydroseeding is required, payment for hydroseeding will be made as per Division 7 Section 5.

9.0 WARRANTY

1.0 DESCRIPTION

This item shall consist of supplying, installing, maintaining and dispersing (if necessary) a water permeable windrow or berm of approved compost or bark material to contain soil erosion by removing suspended soil particles from water moving through or off the construction site.

2.0 REFERENCES

- AASHTO Designation MP 9; AASHTO Standard Specification: Compost for Erosion / Sediment Control (Filter Berms)
- AASHTO Designation T 265-93 (2000) Laboratory Determination of Moisture Content of Soils
- AASHTO Designation T 267-86 (2000) Determination of Organic Content in Soils by Loss on Ignition

3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

Prior to delivery of the bark or compost to the site, the Contractor shall provide the Project Engineer with certification that the bark or compost conforms to the above requirements. The Project Engineer may also request the Contractor to provide a sample of the bark or compost for confirmatory testing.

4.0 MATERIALS

4.1 Bark Filter Berm. The bark material shall consist of weed free bark/wood waste that conforms to the following requirements:

- pH: 4.0 - 8.5
- Particle size: 98% passing a 28 000 µm sieve, 90% passing a 20 000 µm sieve, and not more than 30% passing a 5 000 µm sieve. Material shall not exceed ten (10) cm in length.
- Moisture content less than 60% by wet weight basis.
- Organic matter more than 70% by dry weight basis.
- No visible refuse material nor any material toxic to plant establishment or growth.

4.2 Compost Filter Berm. Compost material must be derived from aerobic decomposition of organic materials as described in *Special Provision, Supplying and Placing Compost*. It shall meet the same physical requirements as the bark filter berm. The compost filter berm material may be used on its own or in combination with the bark filter berm material to a maximum of 50%.

5.0 CONSTRUCTION METHODS

The erosion control berm shall be placed, un-compacted in a windrow at locations shown on the plans or as directed by the Project Engineer. The berms shall follow the contour or be perpendicular to the slope. Berms shall not be used on slopes steeper than 1.5:1. The minimum dimensions of the berm shall be 60 cm wide at the top, 120 cm wide at the bottom and 60 cm in height. After initial construction, the Contractor shall inspect berms to ensure they are in functioning condition and properly located for effectiveness.

Smaller berms may be used across slopes, perpendicular to the slope, to decrease the length of the slope in order to slow runoff water. The dimension of these berms will be as per the contract drawings.

Filter berms may be removed when they are no longer required. At the discretion of the Project Engineer, the berm material may be distributed over an adjacent area for use as a soil amendment or soil cover. Berms, retained as part of the landscape, may be hydroseeded.

6.0 QUALITY CONTROL/QUALITY ASSURANCE

7.0 METHOD OF MEASUREMENT

Measurement shall be by the linear metre, acceptably applied and in place, measured from end to end along the contour of the ground.

8.0 BASIS OF PAYMENT

- Bark Filter Berm
- Compost Filter Berm
- Bark/Compost Filter Berm

Payment at the contract unit price for the above tender item(s) shall be full compensation for all labour, equipment and material necessary to complete the work.

The Contractor shall, at their own expense, repair any berms damaged as a result of improper installation, as determined by the Project Engineer.

Payment will be made as per Division 7 Section 4 for berms requiring repair if the original berms had been properly installed and approved by the Project Engineer and failure was not attributable to the Contractor.

Payment will be made as per Division 7 Section 4 for the maintenance and removal and management of sediment that is accumulated by berms as directed by the Project Engineer.

If hydroseeding is required, payment for hydroseeding will be made as per Division 7 Section 5.

9.0 WARRANTY

1.0 DESCRIPTION

Wire Backed Silt Fence Barrier, also known as *'Type 2 Silt Fence,'* is typically specified for use near watercourses. Construction shall include the supply and installation of a fence composed of steel tee-rails or rebar (reinforcing bar), steel wire mesh (100mm x 50mm mesh or 'page wire' fencing), and geotextile fabric as described below and in accordance with the Department plan contained in Figure 1 (see below). The geotextile shall completely cover the wire fence. The barrier shall be installed with minimum disruption to the existing ground and additional sections shall be lapped a minimum of 300 mm. The geotextile fabric shall be keyed into the ground a minimum of 150 mm and a minimum 150 mm layer of Clear Stone (C5; 19 mm) added to the trench to secure the geotextile.

2.0 REFERENCES

3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

The Contractor shall first receive approval from the Project Engineer, prior to ordering geotextiles, or commercially-available Wire Backed Silt Fence Barrier, for delivery to the site. The Contractor shall provide the Project Engineer with a Manufacturer certificate indicating that the proposed material meets the minimum requirements specified herein.

4.0 MATERIALS

Posts: Fence posts shall be steel tee-rails of not less than 32 mm by 32 mm by 2 m in dimension and 2 kg/m in mass, or 2 m lengths of 19 mm (¾") rebar. All wire fasteners and other hardware shall be in accordance with manufacturer's recommendations.

Wire Mesh for Fencing: Wire mesh shall be 14 gauge or heavier steel wire mesh in 50 mm x 100 mm weave or page wire pattern, and at least 0.9 m high.

Geotextile Fabric: The geotextile fabric shall be slit film woven synthetic fibre fabric with sewn seams and with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days. The geotextile fabric shall comply with the following minimum specifications and physical properties:

Grab Tensile Strength, N	600
Mullen Burst, KPa	1800
Permitivity, s^{-1}	0.25
Apparent Opening Size, mm	0.35

Clear Stone (C5; 19 mm): Clean, hard, durable, non-acid-producing stone particles as per Division 3, Section 4 of the Standard Specifications shall be used as shown on Figure 1, or as directed by the Project Engineer.

5.0 CONSTRUCTION METHODS

The Contractor shall carry out the work according to the Environmental Control Plans (ECPs) and Culvert Mitigation Plans (CMPs) as directed by the Project Engineer. All fence grades shall be subject to approval of the Project Engineer.

Prior to construction of the Wire Backed Silt Fence Barrier, the Contractor shall remove any debris and correct minor ground undulations (greater than 0.3 m vertical in a 3 m length) that would interfere with the proper construction and operation of the fence in the required location.

All posts shall be embedded vertically a minimum of 1.1 m into the ground and in line at a minimum 5.0 m spacing.

Corner posts shall be installed whenever the fence line changes direction by more than 20°, and additional (straining) post at changes in elevation of more than 30°.

The geotextile material shall be fastened to the wire fence in an approved fashion, and shall be keyed into the ground at least 150 mm according to the ECPs/CMPs (or as directed by the Project Engineer). A minimum 150 mm layer of Clear Stone shall be added to the up-gradient side of the trench to secure the geotextile.

The Contractor shall inspect the fence daily, and before and after each rain event, to ensure that the fence is in good repair and properly functioning. Note the nature of any runoff water passing through /around the installations. Necessary repairs or deterioration shall be made immediately, or operations ceased until repairs are completed.

If significant volumes of silt (one half of the barrier height) have accumulated against the barrier fence, or silt depths of 300 mm are observed immediately upgradient of the barrier, the silt shall be removed or a second line of barrier installed. Inform the Project Engineer in either case.

6.0 QUALITY CONTROL / QUALITY ASSURANCE

7.0 METHOD OF MEASUREMENT

The quantity to be measured for payment shall be the number of metres of Wire Backed Silt Fence Barrier satisfactorily installed where directed by the Engineer as described herein.

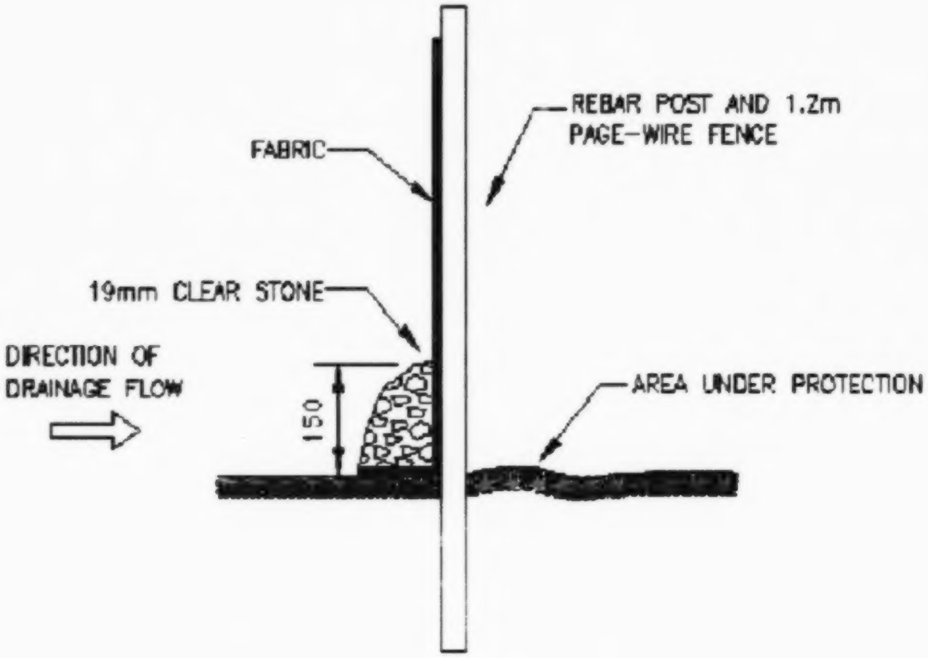
8.0 BASIS OF PAYMENT

Payment for work under this item shall be at the Contract unit bid price per metre.

9.0 WARRANTY

FIGURE 1

WIRE BACKED SILT FENCE BARRIER (TYPE 2 SILT FENCE)


REBAR POST AND 1.2m PAGE-WIRE FENCE
FABRIC
19mm CLEAR STONE
DIRECTION OF DRAINAGE FLOW
150
AREA UNDER PROTECTION

1.0 DESCRIPTION

The Contractor shall prepare a site specific Erosion and Sediment Control (ESC) Plan for any borrow pit, outside the highway right-of-way and larger than 0.5 ha, for the purpose of supplying "common" material on a highway construction project.

2.0 REFERENCES

The environmental control measures and procedures contained in the ESC Plans for borrow pits must comply with the terms and practices referred to in the following documents:

- Nova Scotia Department of Transportation and Public Works **Standard Specification** for Highway Construction and Maintenance; and
- Nova Scotia Department of Transportation and Public Works **Generic Environmental Protection Plan (EPP) for the Construction of 100 Series Highways (latest version)**.

3.0 SUBMISSION AND DESIGN REQUIREMENTS

The ESC Plan should be an independent entity from the working or construction drawings for the project. The Plan should include a written portion and an illustrative portion. The Plan should describe the potential for erosion and sedimentation and explain and illustrate the measures that will be put into place to control these problems.

The **narrative portion** of the Plan must provide enough information so that the Project Engineer (and regulatory authority) can adequately inspect the site and ensure that the Plan is being properly implemented. It should describe where and when the various ESC measures should be installed.

The **illustrative portion** must contain enough information to satisfy the Project Engineer (and regulatory authority) that the problems of erosion and sedimentation have adequately been addressed. The complexity of the illustrations should be appropriate for the size of the borrow pit, the severity of conditions, range in weather conditions, and the potential for off-site sedimentation.

3.1 Narrative Checklist

The narrative portion of the ESC Plan shall include:

- **Project description** - A brief description of the location of the borrow pit, the area (in hectares) expected to be disturbed, and the anticipated period(s) of operation;
- **Existing site conditions** - A brief description of the existing topography, vegetation and drainage (include photographs as appropriate);
- **Adjacent areas** - A description of adjacent areas of concern such as streams, lakes, residential areas which could be impacted by land disturbance (include photographs);
- **Critical Areas** - A description of areas on the borrow pit site that will be disturbed and that have a high potential for erosion, *i.e.* steep slopes, channels, underground springs, etc.
- **Water Control** - A description of how water will be controlled: flowing onto the site, through the site, and leaving the site;
- **ESC measures** - A description of the methods and types of environmental controls that will be used to control erosion and sediment on the site;
- **Sequencing of environmental controls** - A description of when and the sequence in which the environmental controls will be installed on the site;
- **Permanent stabilization** - A description of the method in which the site will be stabilized after excavation has been completed;
- **Contingency Plan** - This plan deals with typical responses to extreme and long duration rainfall events and the failure of ESC measures. Further details are given below; and

- **Monitoring and Maintenance** - A description of the regular inspections and repair of ESC measures that will be carried out on this site.

3.2 Illustrative Checklist

The illustrative portion of the ESC Plan shall include:

- A site plan locating the site in relation to the surrounding area;
- Direction of north in relation to the site;
- Existing contours of the site;
- Limits of clearing and grubbing;
- Direction of groundwater flow onto site;
- Any channelization of flow through the site;
- If required, areas that will be utilized to retain water temporarily on the site;
- Any areas of a high erosion potential; and
- Locations where ESC measures will be installed.

3.3 General Requirements

- The ESC Plan must be submitted to the Project Engineer a minimum of 10 working days in advance of any ground disturbing activity;
- All perimeter ESC measures must be installed prior to any excavation;
- All groundwater flowing onto the site must be controlled and directed through the site by means of stabilized channels;
- If the peak runoff velocity of the water leaving the borrow pit site is greater than pre-construction conditions, then downstream channels will have to stabilized. The preferred option is to maintain existing runoff velocities through temporary retention of water on-site;
- Post-construction runoff velocities from the site should not exceed pre-construction runoff velocities. This may require permanent retention structures being left in place;
- Between the dates of August 30th and April 1st each year, the establishment of vegetative cover through seeding should not be relied upon to protect exposed soil. During this period alternative cover types should be utilized such as a clean rock, erosion control blanket, mulching or in some cases sodding for permanent cover, or mulching with weed-free hay in temporary situations; and
- Work in or near a watercourse is not normally permitted between September 30th and June 1st. However, excavation work in adjacent areas still has the potential to cause siltation. With respect to such work, between the dates of November 30th and May 1st each year, existing vegetation should not be relied upon as a filtering medium for silt laden water. Alternatives include settling ponds and geotextile silt bags.

3.4 Contingency Plan

Essential components of the plan shall include the following:

- Staff training (*e.g.*, tailgate/toolbox safety and environmental meetings to inform/educate staff of potential problems and hazards);
- Storm preparedness (conditions for work stoppages, pre-storm staff meetings, inspection of all ESC measures, preventative maintenance of ESC measures, cover applied to exposed soil, clean-out of any settling ponds and check dams, and proactive measures that the Contractor shall implement to ensure critical ESC measures will withstand storm runoff, snow melt and wind/ice conditions);
- Confirmed availability of equipment and operators that can be mobilized on short notice to create/repair berms, dams, diversion ditches, and settling ponds;
- Stockpiles of ESC materials (include quantities and locations for strategic placements);
    - straw/hay bales, compost, and/or bark (to be used as mulch/cover material)
    - ESC blankets/matting and staples (or tarps/plastic sheeting)
    - Sandbags, clear stone
    - Water pumps, hoses and fuel (the latter to be stored in a 'safe' location)

- Typical approaches for temporary control of water flow and erosion until new ESC measures can be implemented (*e.g.*, excavation of cross ditches to divert runoff into settling ponds or vegetated areas, excavation of temporary water storage areas, berm construction, and bank stabilization). Note that approaches will vary depending upon season, and the Contractor shall indicate approaches for (a) summer, low flow periods, (b) spring-fall, high flow periods, and (c) frozen ground, high-flow periods;
- Standard protocols for notification of ESC failure to the Project Engineer (and NSEL/DFO inspectors depending upon the magnitude); and
- Incident and 'Near Miss' reporting to the Project Engineer and Environmental Services Section to provide documentation of ESC failure (a *Near Miss Report* details failures that did not result in the loss/release of sediment; the intention is identify the cause and help prevent future occurrences).

INTRODUCTION

Riparian buffer zones act as "strategic" buffers between roadways and the aquatic ecosystems of streams and lakes. Their most important functions include filtering and retaining sediment, immobilizing, storing, and transforming chemical inputs from roadways, maintaining stream bank stability, modifying aquatic environments for fish habitat and providing water storage and recharge of subsurface aquifers. The effectiveness of these processes will depend on the vegetation, soil characteristics such as porosity, aeration, pH and organic matter content, the depth to shallow groundwater and the rate surface and subsurface waters move through the buffer strip. Buffers also contribute to landscape biodiversity by providing diverse habitats and corridors for animals and plants. Further information about the design of buffers is given in an *Attachment* at the end of this document.

1.0 DESCRIPTION

This item shall consist of the supply and placement of a topsoil over a neutral to alkaline pH subsoil in a riparian buffer area which is to be stabilized by establishing a dense permanent vegetated cover capable of filtering and retaining sediment and chemical inputs.

2.0 REFERENCES

All reference standards shall be current issue or latest revision at the first date of tender advertisement. This special provision refers to the following standards, specifications and publications:

- ASTM D 4972, Test Method for pH of Soil
- ASTM 2974, Test Method for Moisture, Ash and Organic Matter of Peat and other Organic Materials
- *Standard Specifications* Division 7, Sections 5, 6, 7 and 16
- *Standard Specifications* Division 3, Section 2
- Landscape Nova Scotia Horticultural Trades Association: Topsoil Specifications and the Soil and Compost Use Guidelines
- TPW, Environmental Services: *Background for the Design of Vegetated Buffer Zones*

3.0 SUBMISSIONS AND DESIGN REQUIREMENTS

3.1 Soil Analysis. The Contractor shall take soil samples of all soils to be seeded, prior to spreading, and shall submit them to the Nova Scotia Department of Agriculture and Fisheries, Quality Evaluation Division, Laboratory Services Section, at 176 College Road (or Box 550), Harlow Institute in Truro, NS, B2N 5E3 (or other approved laboratory) for a “Standard Test” soil analysis and resulting recommendations based on growing “Coarse Turf”. Soils samples for laboratory testing shall consist of approximately 500 ml of material that is a composite of a minimum of 20 individual samples taken randomly from soils that appear uniform in colour and texture. Each type of soil proposed to be mixed into the final blend shall be analyzed. The results of the laboratory analysis shall be submitted to the Project Engineer and Vegetation Specialist for recommendations of amendments and final approval.

3.2 Soil Texture. The Contractor shall manually determine the soil texture of soils to be mixed or seeded (see Table 1). A handful of soil can be rubbed between the fingers to feel the amount of ‘grittiness’ to it. Sand has the largest particles, which feel "gritty". Silt has medium sized particles that feel soft, silky or "floury". Clay has the smallest particles and feels "sticky".

Cast Test: A moist soil sample is to be squeezed in the hand. If the soil forms a cast, then toss it from hand to hand to test strength of cast. A more durable cast indicates more clay is present.

Ribbon Test: Moist soil is to be rolled into a cigarette-shape between palms of hands, then rolled out between thumb and forefinger to form the longest, thinnest ribbon possible. The longer the ribbon, the more clay it contains.

The Contractor shall submit a plan to the Project Engineer and Vegetation Specialist for using available on-site soils and intended mixing of those soils to achieve a suitable growing media for the establishment of dense, thick vegetative cover, as shown on the vegetation plan.

Table 1. Field Testing Soil Texture.

Class	Visual	Reaction When Squeezed in the Hand		
		Dry Soil	Moist Soil	Ability to Form a Ribbon
Sand soils	Granular with easily seen particles	Will not form a cast, or cast easily falls apart	Forms a cast that falls apart easily	Cannot form a ribbon
Loam soils	Low to moderately granular Can form clumps when dry	Forms a cast that can be handled some what easily	Forms a cast that can be easily handled	Pure loam cannot form a ribbon Loam with more silt and clay will form fragile ribbon
Clay soils	Fine texture with very few large particles When dry, forms hard clumps	Forms a cast that can be handled freely	Forms a cast that can be worked and sticks together	Forms a long, flexible ribbon

3.3 Subsoils. The Contractor shall determine the pH of the subsoil material and submit that value to the Project Engineer for approval prior to application.

4.0 MATERIALS

4.1 Subsoil Material

The subsoil media shall be free draining and composed of crushed rock, gravel or limestone. It shall have a pH of 7.0 or higher. It shall be free from flat, elongated or objectionable pieces. The subsoil media shall be approved by the Project Engineer prior to utilization.

4.2 Topsoil

The topsoil media shall be free draining and consist of a loam, silt loam, clay loam, loamy sand or sandy loam texture capable of supporting a healthy vegetative cover. In situ soils may be amended with sand and compost to provide appropriate texture and organic content. The topsoil media shall have a pH of 6 to 7.5, an organic matter content of greater than 8% and less than 20% and shall be free of stones, lumps or objects greater than 60 mm. It shall be free from noxious weeds and free of any material toxic to plant growth. The topsoil media shall be approved by the Project Engineer and Vegetation Specialist prior to utilization.

4.3 Compost

Compost is the preferred soil amendment and shall meet the requirements of *Standard Specifications, Division 7 Section 16*. It may be used up to 30% by volume to soils low in organic matter and/or soils with high quantities of sand or clay.

4.4 Hydroseed Seed Mix

The seed mixture shall be applied hydraulically according to *Standard Specifications Division 7 Section 5*. This specification covers the seed mix, the rate of seed and fertilizer applications, cellulose hydro-mulch and liming requirements.

4.5 Mulch

Mulch, if required in the vegetation plan, is to be applied after shrubs and trees are planted and shall be of aged hardwood or comparable wood-based product.

5.0 CONSTRUCTION METHODS

When the surface to be vegetated consists of rock fill or rip rap, a subsoil media shall be evenly distributed over the rock to a minimum depth of 125 mm on top of the rock fill and compacted into the spaces between rocks. It shall be tilled to a depth of 75 mm prior to spreading of topsoil to properly bond the topsoil to the subsoil.

The topsoil media shall be uniformly distributed over the subsoil base to a compacted minimum depth of 200 mm. There shall be no bare areas of rocks, gravel or hardpan at the surface. The surface soil shall be tilled or loosened to a depth of 50 mm to leave the soil surface in a loose, friable condition. Bulldozers or other tracked machinery which are used to loosen the soil surface shall leave the surface with track ridges running parallel to the slope of the site. The surface shall meet the contours and elevations indicated on the drawings, or as directed by the Project Engineer.

The topsoil shall not be placed and distributed while frozen or muddy or when the subgrade is frozen or excessively wet.

The prepared area shall be immediately hydroseeded, according to *Standard Specifications Division 7 Section 5*, and if on a slope of greater than 4:1, subsequently covered with a suitable erosion control blanket. On more shallow slopes, the seeded area may be mulched with chopped hay according to *Standard Specifications Division 7 Section 6.*

6.0 QUALITY CONTROL / QUALITY ASSURANCE

The Contractor shall accomplish the work in an orderly progression to minimize the time topsoil is stockpiled before re-use.

The Contractor or sub contractor shall demonstrate knowledge of basic horticultural and erosion control principles for establishing vegetation, and be trained and experienced in the skills necessary to meet the performance requirements of the Contract.

Use of topsoil and recommended amendments to grow quality coarse turf shall be based on the soil analysis results from a qualified laboratory and from field testing soil texture.

7.0 METHOD OF MEASUREMENT

Where topsoil is to be drawn from stockpiles built by the Contractor or from existing stockpiles designated in the contract and placed, measurement shall be made in square metres of surface covered, measured along the slope of the ground.

8.0 BASIS OF PAYMENT

Payment for topsoil will be at the contract unit price per square metre which shall be full compensation for all labour, equipment and materials (including pulverized limestone and compost) necessary to do the work.

The salvaging and stockpiling of topsoil obtained on site will not be measured for payment but shall be considered as incidental to *Standard Specifications* Division 2 Section 3.

The costs incurred by the Contractor for handling, stockpiling and transporting topsoil will be considered as incidental to the work.

9.0 WARRANTY

During the duration of the Contract any areas showing erosion or poor seed mix establishment shall be repaired and re-seeded to prevent the loss of sediment from the construction site.

ATTACHMENT

Background for the Design of Vegetated Buffer Zones

Riparian buffer zones will be designed to act as "strategic" buffers between roadways and the aquatic ecosystems of streams and lakes. Their most important functions include filtering and retaining sediment, immobilizing, storing, and transforming chemical inputs from roadways, maintaining stream bank or lake shore stability, modifying aquatic environments for fish habitat and providing water storage and recharge of subsurface aquifers. The more riparian zones can perform natural functions the more diverse, productive and resilient the aquatic ecosystem will be. The effectiveness of these processes will depend on the vegetation, the soil characteristics, the depth to shallow groundwater and the rate surface and subsurface waters move through the buffer strip. Soil characteristics such as porosity, aeration, pH and organic matter are important not only for the type of vegetation, but also for drainage, moisture availability, the retention of metal contaminants and degradation of organic pollutants. Alkaline soils and subsoils promote metal removal, which may also be enhanced by spreading a layer of organic matter such as compost on the soil surface. Buffers also contribute to landscape biodiversity by providing diverse habitats and travel corridors for animals and plants.

Riparian Vegetation

Riparian vegetation consists of woody, herbaceous and grass-like plant species. The woody and fibrous roots provide strength to hold slopes and stream banks in place. The roots increase soil stability by mechanically reinforcing soil. The deep rooting habit of woody plants extract more water from greater soil depths than shallow rooted plants and provide superior soil stabilization when compared to herbaceous plants. They also provide protection against the hydraulic pressures of high flows while fibrous roots bind the finer soil particles. Taller growing, woody plants control the quantity and quality of solar radiation reaching the water surface and provide small organic matter inputs to the water. Organic matter input into the watercourse from riparian vegetation serves as an energy source for aquatic organisms. Large woody debris in stream channels influence the physical structure by creating pools, which store and detain sediments, and riffles which help oxygenate the water.

Grasses and grass like plants provide a high density of stems needed to dissipate the energy of surface runoff. The deep and dense annual root systems increase soil infiltration capacities and provide organic matter for large microbial populations. Microbes contribute to the degradation of organic compounds such as pesticides. However, this is dependent on having readily available organic matter in the soil.

Design of Vegetation Zones

Typically, in highway construction projects, there is minimal width available to construct a vegetated buffer area, and the area is typically on a slope. Since most chemical transformation and retention occurs at or near substrates of sediments or plant litter, vegetation and decaying plant litter has a much greater capacity for pollutant removal than poorly vegetated soil. Consequently, topsoils will be of suitable quality with high organic matter to accelerate vegetation establishment and litter buildup (organic substrate) to improve chemical retention. Natural topsoils with native plant propagules will facilitate active natural regeneration; salvaging of in situ soils and vegetation will be utilized in site-specific plans.

Wherever possible, site-specific vegetation plans will include the following vegetation zones:

Zone 1 consists of a strip of trees or large shrubs that begins at the edge of the water. It provides the final buffer for materials moving through the buffer strip and directly provides shade, habitat for insects and birds, and organic matter input to aquatic systems. The trees provide perennial root systems and long-term nutrient storage close to the watercourse. These tree species should include fast-growing, riparian species such as Willow (*Salix spp*) and Poplar (*Populus spp*) species. Other slower growing deciduous (Birch, Maple) and conifer (Larch, Spruce) trees may also be used.

Zone 2 is a minimum of 4 m wide and consists primarily of shrubs with herbaceous plants that are tolerant of differing degrees of soil moisture. It provides an area of maximum infiltration of surface runoff, nutrient uptake and storage while also providing organic matter for microbial processing of organic pollutants. More woody stems near the ground slow water flows during high flow conditions and provide wildlife habitat.

Zone 3 is a minimum 6 m wide zone of grasses and wild flowers which dissipates surface runoff and filters sediment from sheet flow generated from highway runoff. Large quantities of water and runoff compounds infiltrate into the biologically active rooting zone where nutrient uptake and microbial processing occur. The deep and dense annual root systems increase soil infiltration capacities and provide organic matter for large microbial populations.

Planting Techniques

Planting techniques and plant species will be included in site-specific vegetation plans. Salvaging of in situ plant communities with their soils will be conducted as part of the construction process when possible. The three basic planting techniques will be (1) Hydroseeding a mix of grasses and legumes; (2) Planting individual trees and shrubs from plant material propagated from the site; and, (3) Bioengineering techniques using dormant woody species:

Zone 1: Shoreline

To accelerate tree establishment dormant Willow and Poplar posts (>8 cm in diameter) and stakes (3-8 cm in diameter) can be driven into the stream or lake shore substrate in a row at the edge of the water at a spacing of 1.0 - 1.5 m. Several rows, spaced at 0.5 to 1.5 m, can be installed moving away from the shoreline.

Where bank stability is a problem along flowing streams, willow posts can be inserted with anchored dead tree revetments to absorb stream energy and trap sediment before grown enough to provide shade and organic matter for aquatic biota. Another technique is to tie 3 - 4 m long bundles of maple, birch, willow and/or alder together and lay them along the bottom row of posts with the butt ends facing upstream, and the bundles tied to the posts.

Zone 2 - Shrub Zone

Shrub species such as Meadowsweet (*Spirea latifolia*), Red Osier Dogwood (*Cornus sericea*), Elderberry (*Sambucus*), Wild Rose (*Rosa virginiana*) and Pussy Willow (*Salix spp*) can be introduced as dormant cuttings in Brush Layers, Stakes and Wattles. Other shrub species that are found on specific sites may be introduced this way, when research indicates their suitability for establishment from cuttings.

Zone 3 - Grassy Zone

This zone will be established through seeding a suitable seed mix.

NOVA SCOTIA
Transportation and Public Works

APPENDIX B

WORK PROGRESSION SCHEDULE

WORK PROGRESSION SCHEDULE

Example Table - For Guidance Only. Contractor to prepare the schedule for approval by the Project Engineer

Area #	Area bounded by			Timing constraints	
	Station	Offset Left	Offset Right	Time interval from commencement of contract to completion	Timing Constraints
1	2+750 3+500	0 - 40 m 0 - 40 m		Day 1-30 June 20 - July 20	Commencement no earlier than June 1. Completion no later than September 30.
2	3+800 4+900	ROW limit ROW limit	ROW limit ROW limit	Day 20 - 50 July 10 - Aug 9	No constraint
3	5+000 6+200	ROW limit ROW limit	30 - 50 m 30 - 50 m	Day 25 - 55 July 15 - Aug 14	Commencement no earlier than June 1. Completion no later than September 30.
4	6+200 7+000	ROW limit ROW limit	ROW limit ROW limit	Day 50 - 80 Aug 9 - Sept 9	Rock to be placed in lake only between Aug 15 and Sept 30

WORK PROGRESSION SCHEDULE

HIGHWAY 1xx - XXX

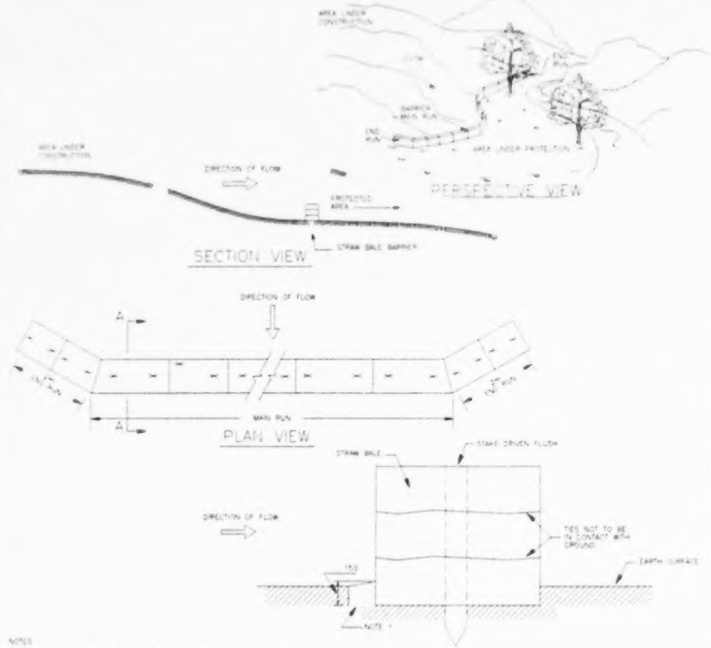
Area #	Area bounded by			Timing constraints	
	Station	Offset Left	Offset Right	Time interval from commencement of contract to completion	Timing Constraints

WHITE - CONTRACTOR YELLOW - RESIDENT ENGINEER PINK - CONSTRUCTION MANAGER

NOVA SCOTIA
Transportation and Public Works

APPENDIX C

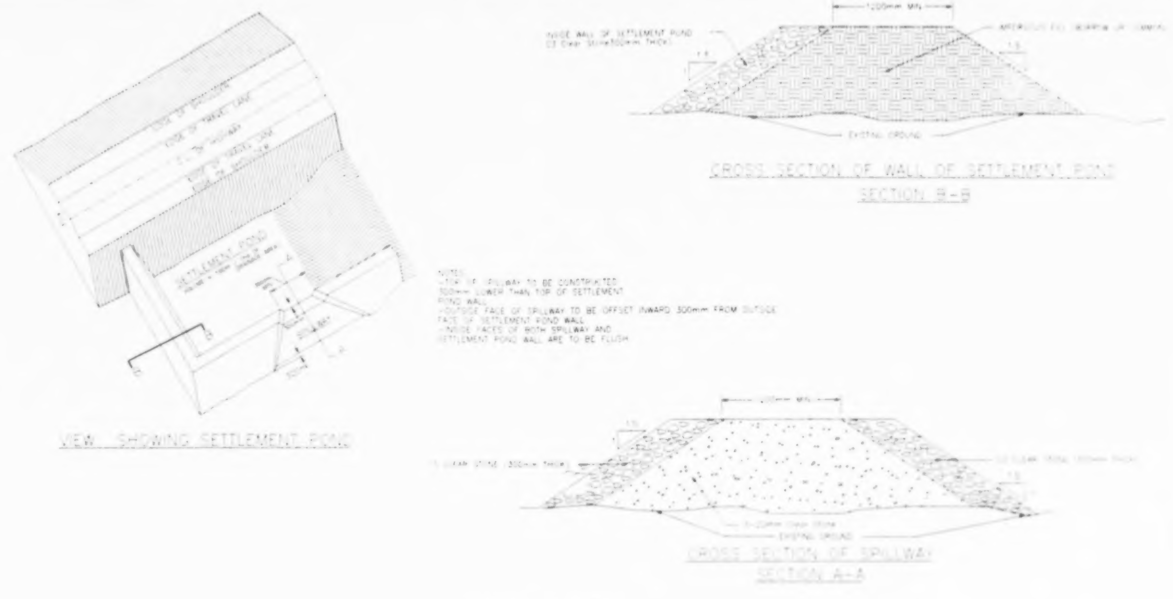
EROSION AND SEDIMENT CONTROLS - TYPICAL DETAILS


AREA UNDER CONSTRUCTION
END RUN
BARRIER MAIN RUN
AREA UNDER PROTECTION
PERSPECTIVE VIEW
DIRECTION OF FLOW
PROTECTED AREA
STRAW BALE BARRIER
SECTION VIEW
A
MAIN RUN
PLAN VIEW
STRAW BALE
STAKE DRIVEN FLUSH
TIES NOT TO BE IN CONTACT WITH GROUND
EARTH SURFACE
150
NOTE 1
SECTION A-A

NOTES

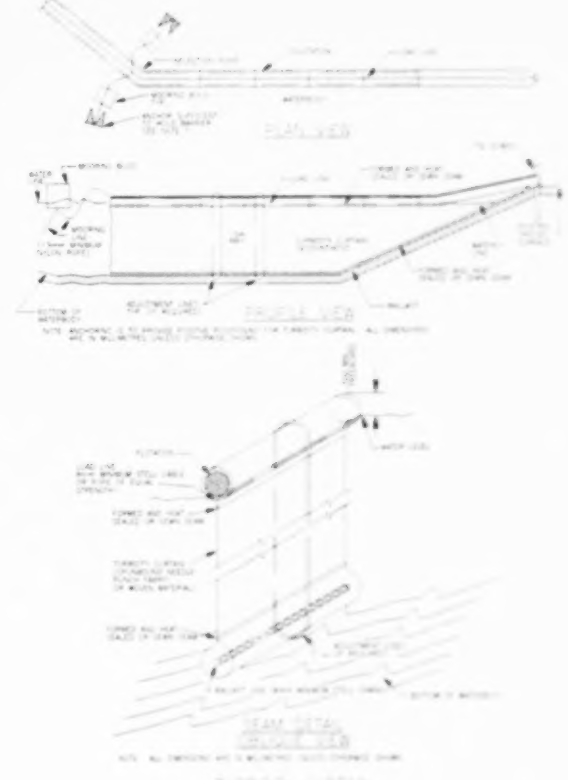
1. BALANCE OF EXCAVATED TRENCH TO BE BACKFILLED FOLLOWING BALE PLACEMENT
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

STRAW BALE BARRIER
NTS

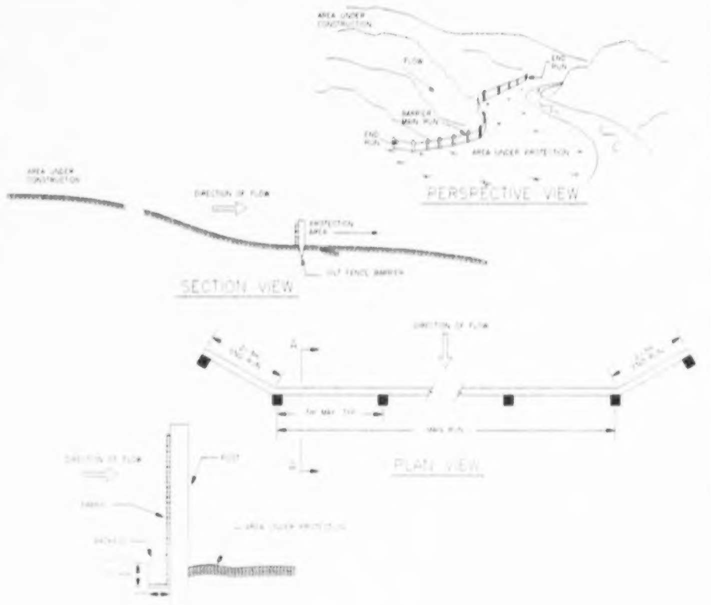

1200mm MIN
INSIDE WALL OF SETTLEMENT POND
CROSS SECTION OF WALL OF SETTLEMENT POND
SECTION B-B
VIEW SHOWING SETTLEMENT POND
EXISTING GROUND
1200mm MIN
CROSS SECTION OF SPILLWAY
SECTION A-A

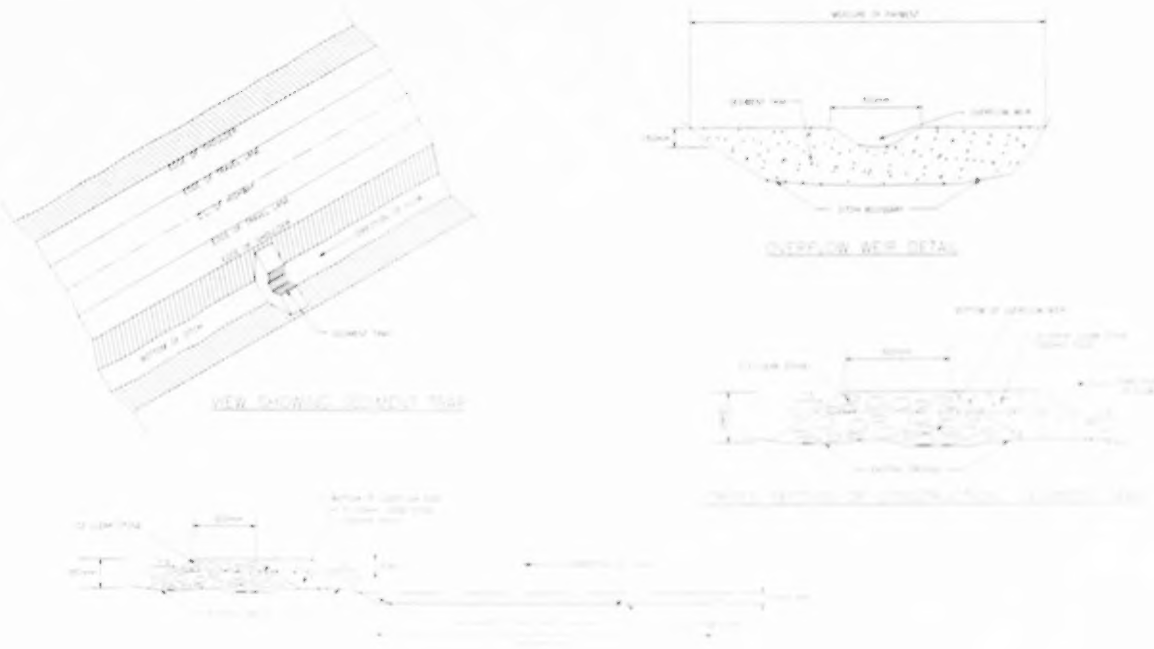
NOTES
-TOP OF SPILLWAY TO BE CONSTRUCTED 300mm LOWER THAN TOP OF SETTLEMENT POND WALL
-OUTSIDE FACE OF SPILLWAY TO BE OFFSET INWARD 300mm FROM OUTSIDE FACE OF SETTLEMENT POND WALL
-INSIDE FACES OF BOTH SPILLWAY AND SETTLEMENT POND WALL ARE TO BE FLUSH

SETTLEMENT PONDS
NTS


PLAN VIEW
PROFILE VIEW
FLOTATION
WATER LEVEL
BALLAST
SEAM DETAIL

TURBIDITY CURTAIN
NTS


AREA UNDER CONSTRUCTION
FLOW
END RUN
BARRIER MAIN RUN
AREA UNDER PROTECTION
PERSPECTIVE VIEW
DIRECTION OF FLOW
PROTECTED AREA
SILT FENCE BARRIER
SECTION VIEW
A
MAIN RUN
PLAN VIEW
POST
AREA UNDER PROTECTION


VIEW SHOWING SEDIMENT TRAP
SEDIMENT TRAP
EXISTING GROUND
OVERFLOW WEIR DETAIL

DILLON
CONSULTING

Design by:
Drawn by:
Checked by:
Approved by:

MK. DATE REVISION

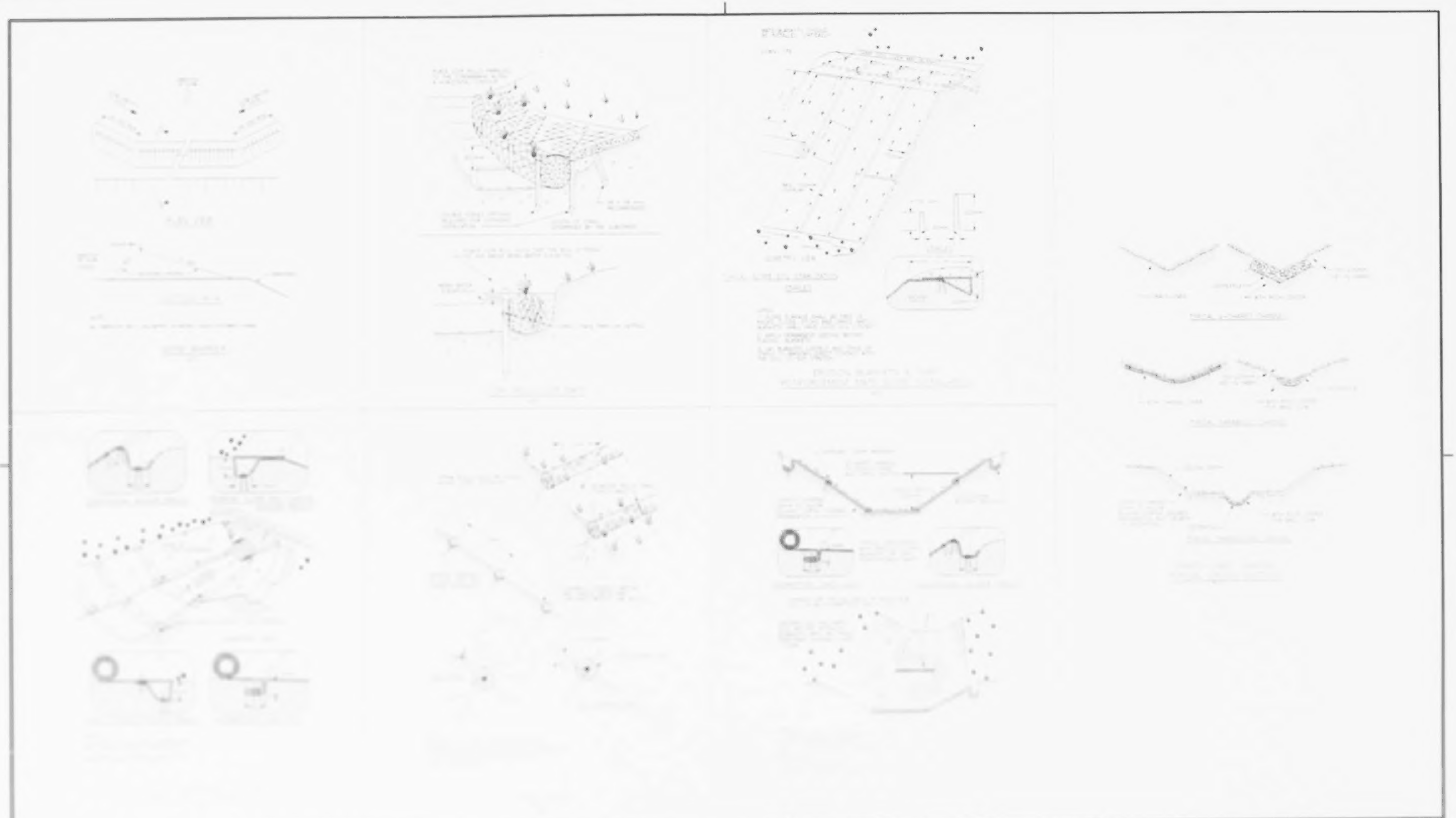
NOVA SCOTIA
Transportation and Public Works
Highway Engineering Services

Manager, Highway Planning & Design Date
Director, Highway Engineering Services Date

Scale N.T.S.
Date
File No.
Sheet No. of

HIGHWAY 125
ENVIRONMENTAL
PROTECTION PLAN

TYPICAL DETAILS

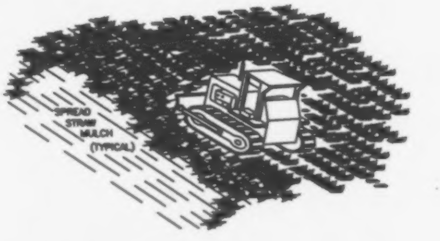


DILLON CONSULTING

NOVA SCOTIA
Transportation and Public Works
Highway Engineering Services

HIGHWAY 125
ENVIRONMENTAL
PROTECTION PLAN

TYPICAL DETAILS

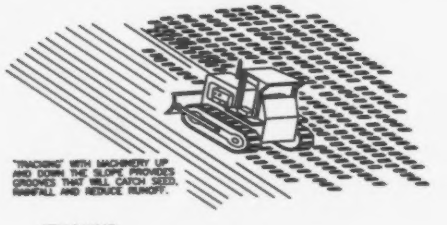

SPREAD STRAW MULCH (TYPICAL)

"TRACKING" WITH MACHINERY ON SANDY SOIL PROVIDES ROUGHENING WITHOUT UNDUE COMPACTION.

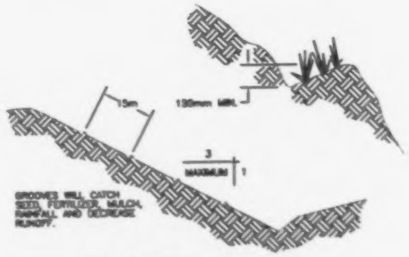
NOTES:

1. ROUGHEN SLOPE WITH BULLDOZER
2. BROADCAST SEED AND FERTILIZER.
3. SPREAD STRAW MULCH AS FOLLOWS:
   - UNPROCESSED HAY OR STRAW MULCH AT A RATE OF 4500 KG/HA.
   - MULCH AT A RATE OF 2200 KG/HA (STEEP SLOPES WILL REQUIRE GREATER QUANTITIES AS DETERMINED BY THE PROJECT ENGINEER).
4. PUNCH STRAW MULCH INTO SLOPE BY RUNNING BULLDOZER UP AND DOWN SLOPE.

TYPICAL STRAW ANCHORING

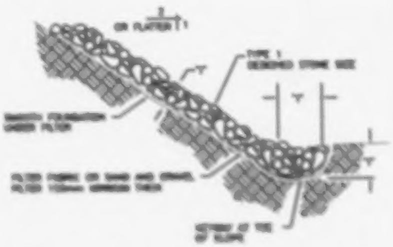

"TRACKING" WITH MACHINERY UP AND DOWN THE SLOPE PROVIDES GROOVES THAT WILL CATCH SEED, RAINFALL AND REDUCE RUNOFF.

TRACKING


1
150mm MIN.
15m
3
MAXIMUM
1
GROOVES WILL CATCH SEED, FERTILIZER, MULCH, RAINFALL AND DECREASE RUNOFF.

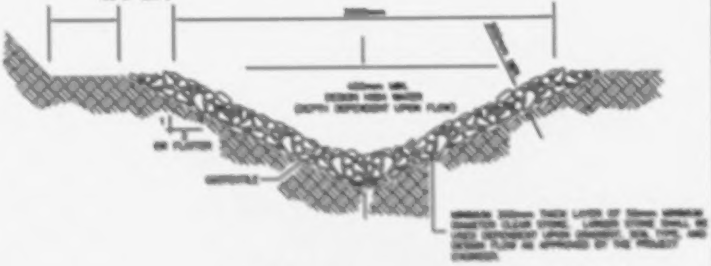
CONTOUR FURROWS

TYPICAL SURFACE ROUGHENING

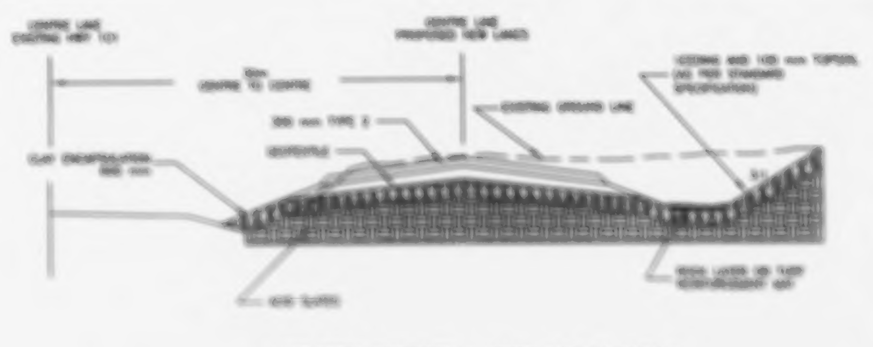

2
OR FLATTER 1
TYPE 1
DESIGNED STONE SIZE
"T"
"T"
SMOOTH FOUNDATION UNDER FILTER
FILTER FABRIC OR SAND AND GRAVEL FILTER 150mm MINIMUM THICK
KEYWAY AT TOE OF SLOPE

NOTE:
"T" = MIN. THICKNESS OF 675mm OR AS APPROVED BY PROJECT ENGINEER
MINIMUM THICKNESS SHALL BE 1.5x THE MAXIMUM STONE DIAMETER, NEVER LESS THAN 150mm.

TYPICAL RIPRAP PROTECTION


SWALE TO BE – MIN. 3000mm FROM TOE OF SLOPE
3000mm
450mm MIN.
DESIGN HIGH WATER
(DEPTH DEPENDENT UPON FLOW)
300mm MIN.
1
2
OR FLATTER
GEOTEXTILE
MINIMUM 300mm THICK LAYER OF 50mm MINIMUM DIAMETER CLEAR STONE. LARGER STONE SHALL BE USED DEPENDENT UPON GRADIENT, SOIL TYPE AND DESIGN FLOW AS APPROVED BY THE PROJECT ENGINEER.

CLEAR STONE LINED SWALE


CENTRE LINE
EXISTING HWY 101
CENTRE LINE
PROPOSED NEW LANES
CENTRE TO CENTRE
SEEDING AND 100 mm TOPSOIL (AS PER STANDARD SPECIFICATION)
EXISTING GROUND LINE
300 mm TYPE 2
GEOTEXTILE
CLAY ENCAPSULATION 600 mm
ACID SLATE

ACID ROCK MITIGATION – GRADE CUT EXPOSURE

DETAILED CONSTRUCTION SEQUENCE – TEMPORARY BRIDGES

IN GENERAL TERMS, THE FOLLOWING SEQUENCE OF CONSTRUCTION AND MITIGATION MEASURES WILL BE FOLLOWED AT ALL TEMPORARY BRIDGES:

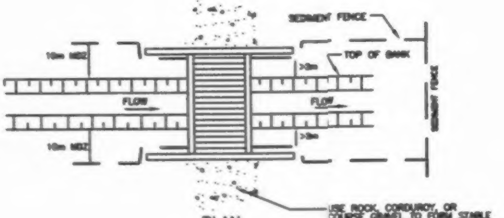
1. INSTALL THE BRIDGE IN A MANNER THAT WILL MINIMIZE SEDIMENT ENTERING THE WATER. BRIDGE MUST BE ENGINEERED TO SUPPORT THE LOADS EXPECTED. CURBS AT LEAST 150 mm HIGH MUST BE INSTALLED ALONG THE EDGE OF THE DECK TO CONTAIN MUD ON THE BRIDGE. FASTENERS CONNECTING COMPONENTS MUST BE STRONG ENOUGH TO HOLD THEM IN POSITION DURING THE LIFE OF THE BRIDGE. CRIBS ARE TO BE FILLED WITH ROCK OR COBBLE. RIP RAP EROSION PROTECTION IS TO BE PLACED AROUND THE CRIBS AND ON FILL SLOPES PROJECTING INTO THE WATER.

2. ROAD APPROACHES LEADING TO BRIDGE CROSSINGS MUST BE RAISED AND STABLE SO THAT EQUIPMENT LOADS ARE SUPPORTED AT A SUFFICIENT DISTANCE BACK FROM THE WATER AS TO REDUCE MUD ENTERING THE STREAM FROM EQUIPMENT TRACKS. THIS MAY REQUIRE USING MATERIALS SUCH AS GRAVEL, ROCK OR CORDUROY. IF CUTS ARE NEEDED TO OBTAIN A SATISFACTORY GRADE, THEY ARE TO BE DUG WITH SIDE DITCHES AND STABLE SLOPES. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED TO KEEP SEDIMENT ON LAND (E.G., FLOW CHECKS, FILTER CLOTH, RIP RAP, SEED AND MULCH, SEDIMENT TRAPS, ETC.).

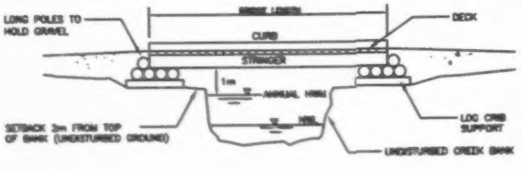
3. ANY BUILDUP OF MUD ON THE TEMPORARY BRIDGE SHOULD BE REMOVED SUCH THAT THERE IS NO IMPACT ON THE WATER QUALITY OF THE WATERCOURSE.

4. TEMPORARY CROSSINGS SHALL BE REMOVED AS QUICKLY AS POSSIBLE WHEN NO LONGER REQUIRED. REMOVAL SHALL NOT OCCUR OUTSIDE THE JUNE 1–SEPTEMBER 30 CONSTRUCTION WINDOW WITHOUT PRIOR WRITTEN APPROVAL FROM DFO AND DEL. SURPLUS GRAVEL AND BRIDGE MATERIALS ARE TO BE REMOVED FROM THE CROSSING AREA AND DISPOSED OF IN AN APPROVED LOCATION. THE CREEK BED AND BANKS ARE TO BE RESTORED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL COMPATIBLE WITH FLOW VELOCITY (E.G. COARSE GRAVEL OR RIP RAP).

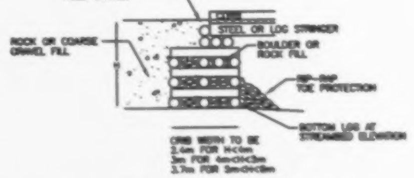
5. WATER CONTROL DURING CONSTRUCTION OF THE TEMPORARY STRUCTURE SHOULD BE IN COMPLIANCE WITH 3.2.1, PROTECTION OF WATERCOURSES & WETLANDS, FOUND IN APPENDIX 'A' OF THIS DOCUMENT.


SEDIMENT FENCE
TOP OF BANK
10m NDZ
10m NDZ
>3m
>3m
FLOW
FLOW
SEDIMENT FENCE
USE ROCK, CORDUROY, OR COURSE GRAVEL TO FORM STABLE APPROACH ROADS EXTENDING BACK FROM WATER'S EDGE.

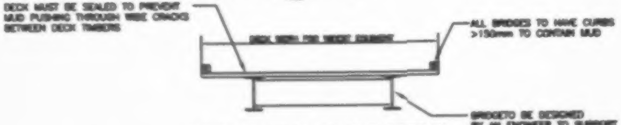
PLAN


LONG POLES TO HOLD GRAVEL
BRIDGE LENGTH
DECK
CURB
STRINGER
1m
ANNUAL HWM
NWL
SETBACK 2m FROM TOP OF BANK (UNDISTURBED GROUND)
LOG CRIB SUPPORT
UNDISTURBED CREEK BANK

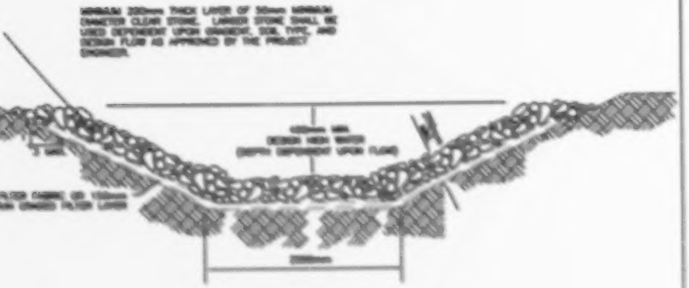
BRIDGE PROFILE


LONG POLES TO HOLD GRAVEL
STEEL OR LOG STRINGER
ROCK OR COARSE GRAVEL FILL
BOULDER OR ROCK FILL
RIP-RAP TOE PROTECTION
BOTTOM LOG AT STREAMBED ELEVATION
CRIB WIDTH TO BE
2.4m FOR H<4m
3m FOR 4m<H<5m
3.7m FOR 5m<H<6m

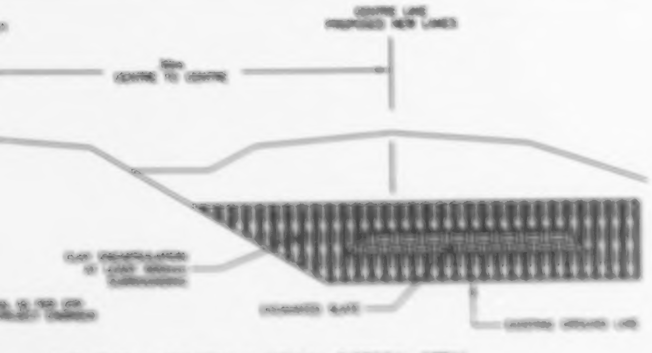
TYPICAL TEMPORARY CRIB ABUTMENT


DECK MUST BE SEALED TO PREVENT MUD PUSHING THROUGH WIDE CRACKS BETWEEN DECK TIMBERS
ALL BRIDGES TO HAVE CURBS >150mm TO CONTAIN MUD
BRIDGETO BE DESIGNED BY AN ENGINEER TO SUPPORT EXPECTED LOADS

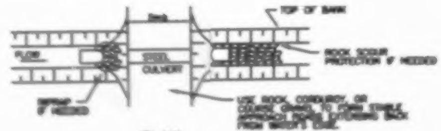
TYPICAL STEEL BRIDGE SECTION


MINIMUM 200mm THICK LAYER OF 50mm MINIMUM DIAMETER CLEAR STONE. LARGER STONE SHALL BE USED DEPENDENT UPON GRADIENT, SOIL TYPE, AND DESIGN FLOW AS APPROVED BY THE PROJECT ENGINEER.
DESIGN HIGH WATER (DEPTH DEPENDENT UPON FLOW)

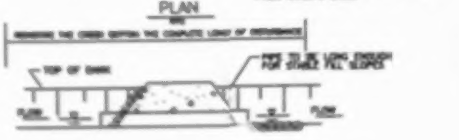
ROCK LINED DRAINAGE DITCH


CENTRE LINE PROPOSED NEW LANES
CENTRE TO CENTRE

ACID ROCK MITIGATION – TYPICAL DISPOSAL DETAIL


TOP OF BANK
FLOW
STEEL CULVERT
ROCK SCOUR PROTECTION IF NEEDED
RIPRAP IF NEEDED
USE ROCK, CORDUROY, OR COURSE GRAVEL TO FORM STABLE APPROACH ROADS EXTENDING BACK FROM WATER'S EDGE.

PLAN


TOP OF BANK
PIPE TO BE LONG ENOUGH FOR STABLE FILL SLOPES
FLOW
FLOW

DETAILED CONSTRUCTION SEQUENCE – TEMPORARY CULVERTS

IN GENERAL TERMS, THE FOLLOWING SEQUENCE OF CONSTRUCTION & [illegible] MEASURES WILL BE FOLLOWED AT ALL TEMPORARY CULVERTS:

1. [illegible]

2. [illegible]

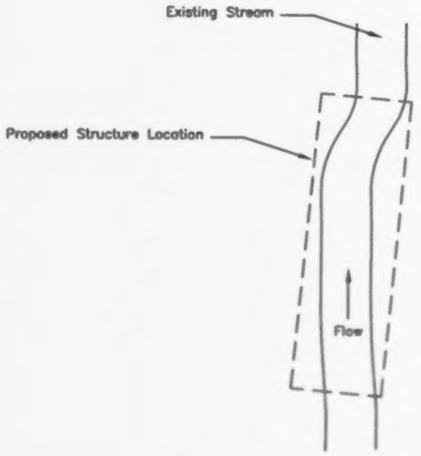
3. [illegible]

4. [illegible]

STREAM PROFILE

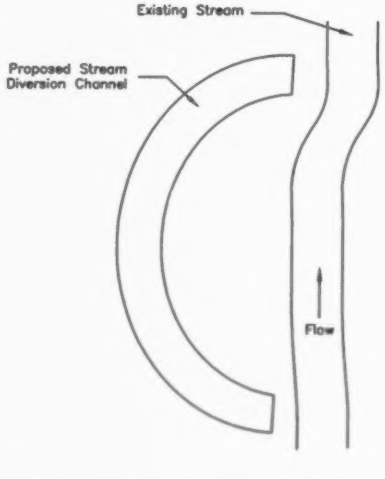
NOVA SCOTIA DEPARTMENT OF TRANSPORTATION & PUBLIC WORKS
ENVIRONMENTAL [illegible] PLAN
TYPICAL DETAILS
TV20007-001
0
AMEC Earth & Environmental Ltd

①


Existing Stream
Proposed Structure Location
Flow

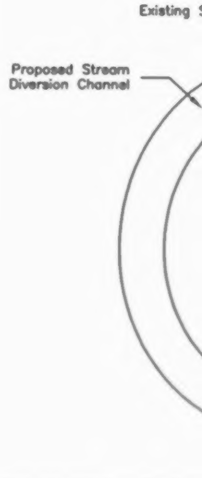
②

Excavate diversion channel leaving earth plugs at both ends. Line diversion channel with plastic or Type A or B gravel depending on stream velocity.


Existing Stream
Proposed Stream Diversion Channel
Flow

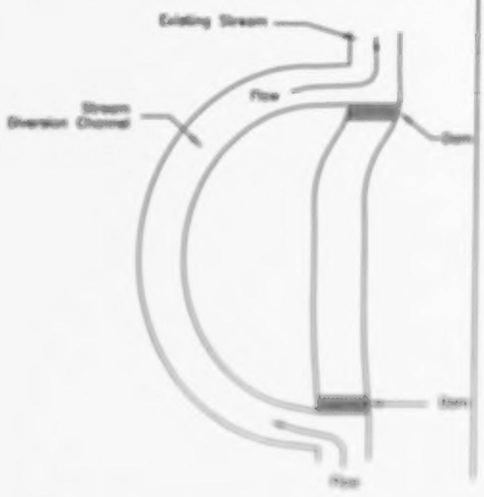
③

Open downstream plug and allow water pressure to equalize in stream diversio
Some sedimentation will occur.


Existing S
Proposed Stream Diversion Channel

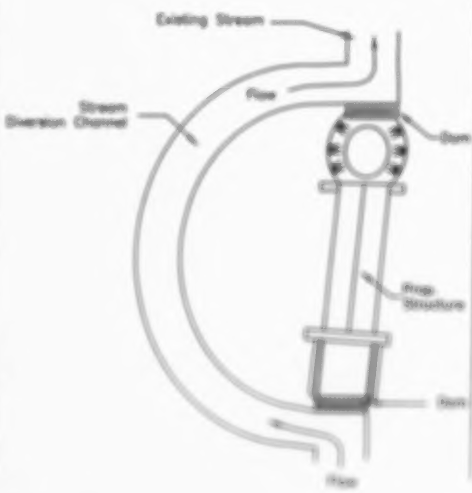
⑥

Immediately install a non-erodible dam downstream to prevent backflow into the construction site. Rescue all fish from the dammed portion of the watercourse. Pumped water must be filtered though vegetation or a filter bag prior to re-entering a live stream. Alternatively, construct a de-watering basin (18 X gal/min. = cu. ft. of storage) to pump out the existing creek.


Existing Stream
Flow
Stream Diversion Channel
Dam
Dam
Flow

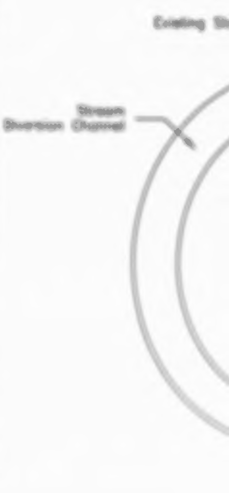
⑦

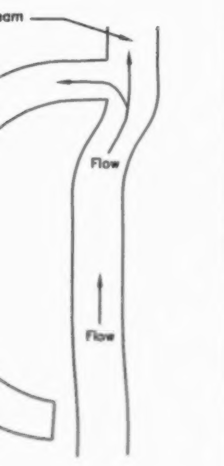
Construct drainage structure. Complete all channel work.


Existing Stream
Flow
Stream Diversion Channel
Dam
Pipe Structure
Dam
Flow

⑧

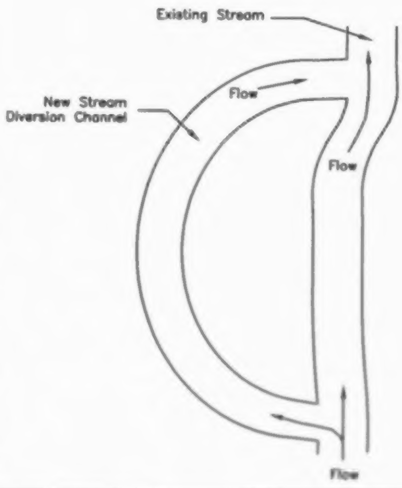
Remove de-watering basin.
Remove downstream dam.


Existing St
Stream Diversion Channel


...eam
Flow
Flow

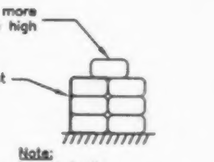
④

Open upstream plug and allow water to flow through both existing stream channel and new stream diversion. Some sedimentation will occur.


Existing Stream
New Stream
Diversion Channel
Flow
Flow
Flow

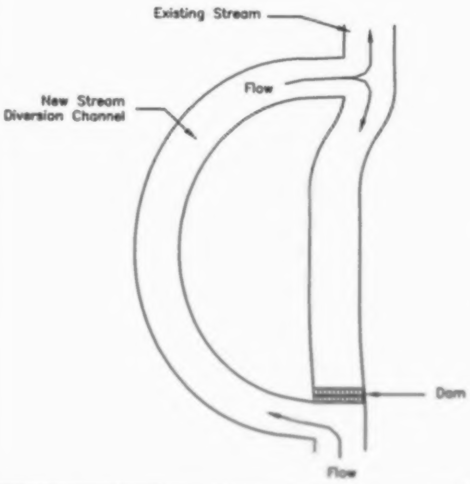
⑤

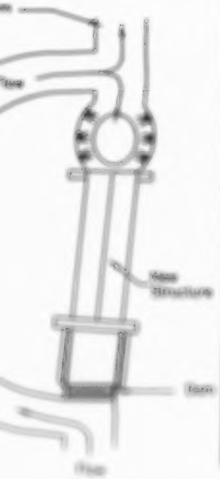
Immediately place a non-erodible dam in the upstream end of the existing channel.


Double with if more than three high
10 mil plastic sheet

Note:
Layers to be staggered to overlap

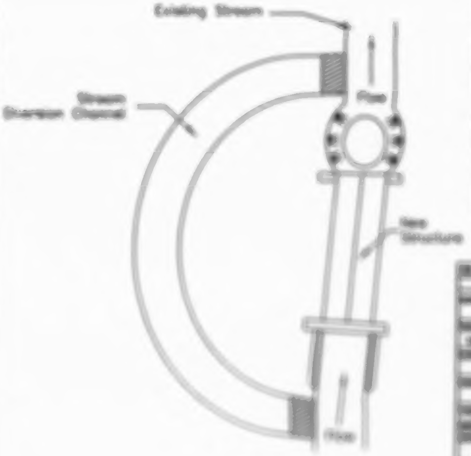
SANDBAG COFFERDAM DETAIL


Existing Stream
New Stream
Diversion Channel
Flow
Dam
Flow


Flow
New
Structure
Dam
Flow

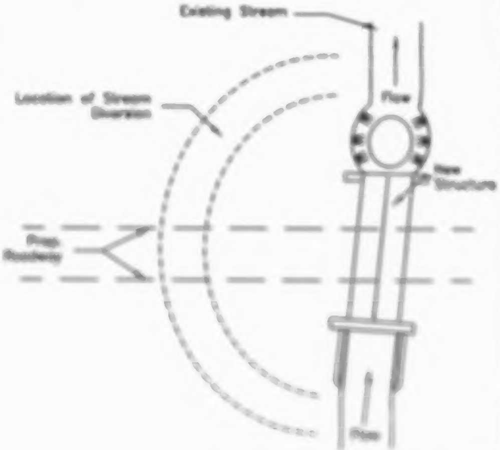
⑨

Remove upstream dam.
Fill in downstream and upstream ends of temporary stream diversion with non-erodible material.


Existing Stream
Stream
Diversion Channel
Flow
New
Structure
Flow

⑩

Fill in remainder of stream diversion.
Stabilize.
Construct Roadway


Existing Stream
Location of Stream
Diversion
Flow
New
Structure
Prop.
Roadway
Flow

NOVA SCOTIA DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

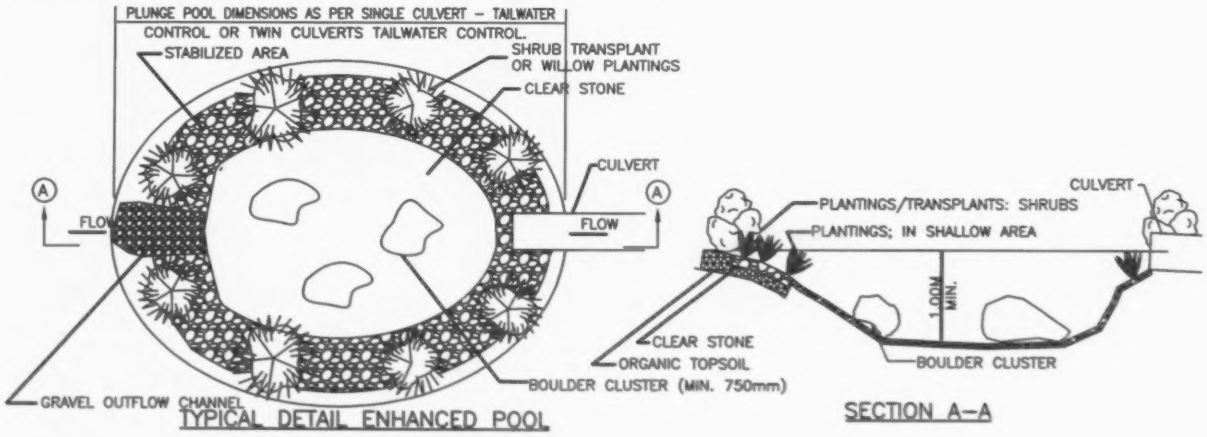
ENVIRONMENTAL PROTECTION PLAN

10 STEPS TO A SUCCESSFUL STREAM DIVERSION

TV20007-002

0

AMEC Earth & Environmental Ltd


PLUNGE POOL DIMENSIONS AS PER SINGLE CULVERT – TAILWATER CONTROL OR TWIN CULVERTS TAILWATER CONTROL.
STABILIZED AREA
SHRUB TRANSPLANT OR WILLOW PLANTINGS
CLEAR STONE
CULVERT
A
FLOW
FLOW
A
GRAVEL OUTFLOW CHANNEL
BOULDER CLUSTER (MIN. 750mm)
CULVERT
PLANTINGS/TRANSPLANTS: SHRUBS
PLANTINGS; IN SHALLOW AREA
1.00M MIN.
CLEAR STONE
ORGANIC TOPSOIL
BOULDER CLUSTER

TYPICAL DETAIL ENHANCED POOL

SECTION A–A

Notes for Enhanced Energy Dissipation Pools

1. Construct culvert and pool 'in the dry' as per typical details. Depth of up to 2.5 m will provide better cover (1 m minimum depth). Culvert should backflood 300 mm. Rootwads may also be used to protect the bank and enhance fish cover.

2. Bottom of pool, outflow channel, and adjacent banks to 0.5 m above the low-flow outlet control should be covered with Clear Stone that is sized according to flood velocities produced by a one in a hundred year storm (hence dependent upon culvert size; see following table). Gravel depth will also vary depending on flow, from approximately 300 to 750 mm. Note that no filter fabric or any form of geotextile shall be used in the construction of the pool.

Culvert Diameter (m)	Average Size of Clear Stone (mm)	Gravel Thickness (mm)
Up to 1.2 (4 feet)	150 (use type C1) (6 inch)	300 (12 inch)
1.2 - 2.1 (4-7 feet)	300 (12 inch)	450 (18 inch)
2.1 - 3.0 (7-10 feet)	600 (24 inch)	750 (30 inch)

3. The stream bottom at the outflow channel (transition zone to the existing stream) shall contain finer gravel approximating that in the existing stream (to fill the voids in the Clear Stone and thereby prevent problems with fish passage during low flows).

4. Install boulder cluster in the pool (3 to 5 pieces; lead rock up to 1000 cm diameter; remaining rocks should be 750-850 mm diameter). Centre of boulders should be 2 m apart.

5. (A) The pool outlet channel shall be designed to have similar cross-sectional area and shape as the notch in culvert baffles. The top of the most downstream baffle will be at the same elevation as the streambed at the top of the pool outlet channel.

   (B) In non-baffle culverts, the width of the pool outlet channel shall be a maximum of one third of the culvert's width (W) and the invert of pool outlet shall be 0.2W higher than the culvert invert.

6. Following completion of the pool and outflow channel, place "Specialty Topsoil for Riparian Zone Vegetated Buffer" in a 3 m-wide, 200 mm-thick, layer around the pool (see Special Provision for Specialty Topsoil). Seed and cover immediately afterwards (see below).

7. Seed or hydroseed the area as per Standard Specification Division 7, Section 5.

8. Place dry mulch or erosion control blanket (ECB) over the "Specialty Topsoil" as per Standard Specification Division 7, Sections 6 and 7. For slopes greater than 3:1, use ECB.

9. Place shrubs, vegetation transplants and, or willow live-stakes in the mulch layer or slits in the ECB as per specifications of TPW's Vegetation Specialist. Spacing shall typically be at 0.5 m centres over approximately 50% of the area.

10. As directed by TPW's Vegetation Specialist, ensure watering of the new vegetation and transplants until the vegetation is established.

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Transportation and Public Works
Highway Engineering Services

No. REVISION

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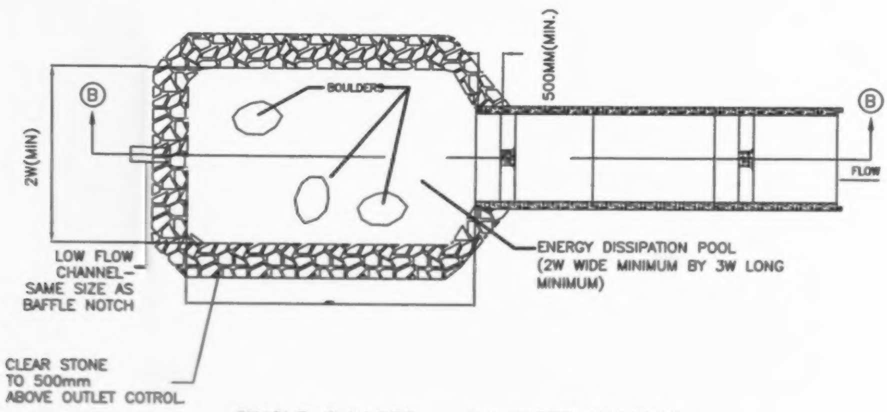
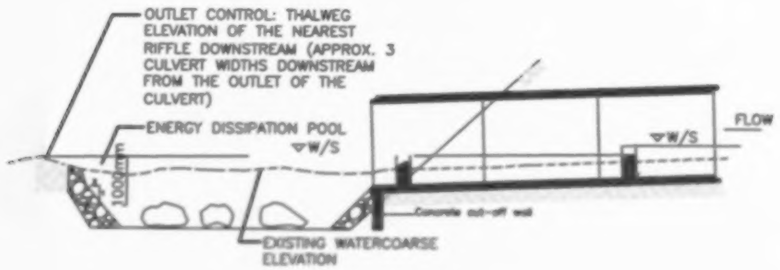
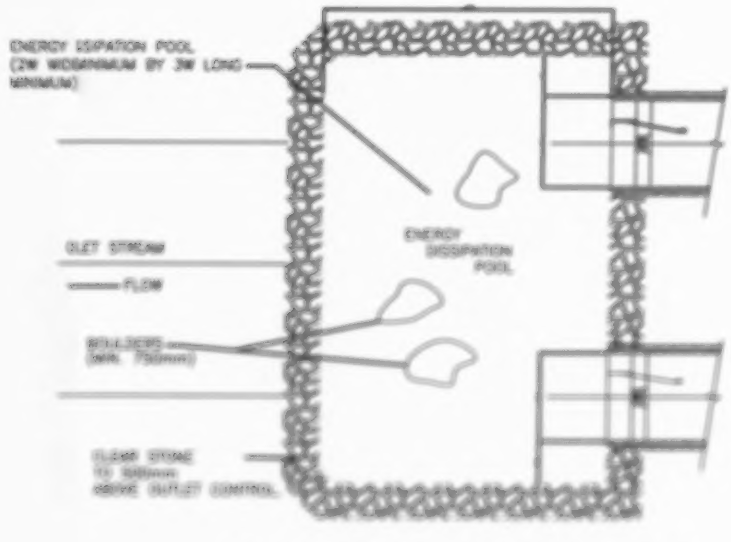

BOULDERS
500MM(MIN.)
2W(MIN)
B
B
FLOW
LOW FLOW CHANNEL– SAME SIZE AS BAFFLE NOTCH
ENERGY DISSIPATION POOL (2W WIDE MINIMUM BY 3W LONG MINIMUM)
CLEAR STONE TO 500mm ABOVE OUTLET COTROL

SINGLE CULVERT – TAILWATER CONTROL


OUTLET CONTROL: THALWEG ELEVATION OF THE NEAREST RIFFLE DOWNSTREAM (APPROX. 3 CULVERT WIDTHS DOWNSTREAM FROM THE OUTLET OF THE CULVERT)
ENERGY DISSIPATION POOL
▽W/S
▽W/S
1000mm
FLOW
Concrete cut-off wall
EXISTING WATERCOARSE ELEVATION

SECTION B–B


ENERGY DSIPATION POOL (2W WIDEMINIMUM BY 3W LONG MINIMUM)
ENERGY DISSIPATION POOL
OLET STREAM
FLOW
BOULDERS (MIN. 750mm)
CLEAR STONE TO 500mm ABOVE OUTLET CONTROL

TWIN CULVERTS – TAIL WATER CONTROL

N.T.S.
K.BODDY
B.PETT
Plan : 05-07-16
H-2005-025-00

Manager Environmental Service

ENHANCED ENERGY DISSIPATION POOLS

NOVA SCOTIA
Transportation and Public Works

APPENDIX D

EPP FOR WINTER CLEARING

Environmental Protection Plan for Winter Clearing on 100 Series Highways

1.0 Introduction

One of the commitments in a CEAA screening is that Right-of-Way (ROW) clearing will be conducted in winter months, in order to minimize disruption to wildlife (in particular nesting birds), as well as minimizing disruption to ground cover which could increase potential for erosion. This portion of the Generic EPP applies **only** for winter clearing. In addition, a 'Project EPP' for construction will be prepared and approved by government regulators and other interested agencies prior to grubbing and further construction.

2.0 Description of the Work

This work applies to clearing of trees within the ROW, including proposed access roads. Access to the ROW will occur at specific locations along the 100 Series Highway designated by the Project Engineer. Vehicles doing the clearing must use a right-in, right-off movement, so they are not in conflict with traffic. Parking will not be permitted on the shoulders. The Contractor will be responsible to follow signing requirements as per TPW□s *Traffic Control Manual*.

Clearing shall consist of cutting all trees within areas designated by the Project Engineer except those trees that have been designated by the Project Engineer to be left standing. The limit of clearing shall be 4m from the theoretical slope. The cut off height shall be 300 mm above the ground level or at such heights as approved by the Project Engineer. Slash and other material shall be chipped and left on site. There shall be no burning of material.

Trees of value as merchantable timber **that are the property of the landowner**, cut from the ROW shall be cut to a minimum length of 2.5 m as approved by the Project Engineer. It shall be piled neatly, in one pile per property owner, on abutting properties off the ROW unless otherwise approved or directed by the Project Engineer. The Contractor shall arrange with the abutting property owners with respect to the cutting and piling of such trees and shall pay all costs involved with this phase of the work. For the purpose of this provision all timber with a minimum butt diameter of 100 mm and a length of 2.5 m shall be considered as merchantable timber.

3.0 Environmental Protection Practices.

3.1 On-site Meetings

An on-site meeting with the Project Engineer and such other representative of TPW as may be required, and representatives of the Department of Fisheries and Oceans (DFO), the Nova Scotia Department of the Environment and Labour (DEL), Environment Canada (EC), and the Contractor will be held prior to the commencement of any work. Other meetings will be held as required throughout the duration of the project.

3.2 Protective Measures

3.2.1 Protection of Watercourses and Wetlands

A watercourse is defined as (i) the bed and shore of every river, stream, lake, creek, pond, spring, lagoon or natural body of water, and the water therein, within the jurisdiction of the Province, whether it contains water or not, and (ii) all groundwater.

A wetland is defined as land that is saturated or covered with water long enough to promote vegetation and biological activity which are adapted to a wet environment.

Three principles will be observed to protect watercourses and wetlands during the duration of the project:

1. Water crossing will only be permitted when access by any other means is impractical or impossible.

2. Activities near watercourses will be designed and performed to avoid erosion and sedimentation both during and after construction activities, and

3. Crossings will not result in a restriction or blockage of natural drainage and/or to fish passage.

Equipment is not allowed to enter watercourses, therefore temporary bridges shall be used where crossing of watercourses is necessary. Temporary bridges are defined as portable structures placed across a watercourse for a period of time ranging from less than one day to one or more weeks. The size of the temporary bridge shall be such that they will not result in a restriction or blockage of natural drainage and/or to fish passage. Crossing of temporary bridges by equipment shall be kept to a minimum. Temporary bridges shall be removed when the work in the area is completed. Any temporary bridge locations must first be approved by DEL. **If the Contractor wishes to use a temporary bridge, they must contact the Project Engineer, who will apply for a Water Approval. This approval can take up to 60 days to obtain, and no claims or extensions will be considered.**

A temporary bridge is not required when the watercourse channel is not defined and is vegetated (*i.e.*, not gravel). However, this alternative crossing method will still require DEL approval and the installation of a brush mat to protect the area.

The general mitigation for water crossings are as follows:

- Crossings will be restricted to a single location and will occur perpendicular to the watercourse and at a narrow point on the watercourse. The crossing site must exhibit a stable soil type and gentle approach slopes;

- A buffer zone will be maintained on each side of a watercourse. In this zone, a 3 m wide travel route may be cut. All slashing and construction debris will be removed by hand and disposed of by chipping above the high water mark and away from the watercourse.

- Buffer zones will be between 10 m and 30 m wide on both sides of the watercourse, depending on the topography leading into the watercourse or wetland (this is a *machine exclusion zone*);

- Trees will be felled away from the watercourse during the clearing operation. Trees felled within the high water mark will be removed immediately;

- Approaches to water crossings will be stabilized with brush mats and banks stabilized by placement of a vegetation mat, where necessary. When bank or approach slopes are composed of erodible soil; riprap, filter fabric or other stabilization measures will be used;

- Under no circumstances is the soil to be disturbed within 10 m of any watercourse. These areas are designated as environmentally sensitive. The trees within this buffer zone shall be hand cleared. Trees shall be felled away from the watercourse. This buffer zone distance may be increased/decreased by the engineer at specific culvert locations;

- Machine access for the removal of hand cut timber in buffer zones shall be on brush mats or swamp mats. The mats shall be placed along the centre of the ROW and shall only be as wide as the machine itself. **The machine is to remain at least 10 m (or the agreed to distance) from the ordinary high water mark of the watercourse;**

- Any merchantable timber or non-salvageable material removed from the buffer zone shall be done in such a manner that the surface is not broken and the underlying soil is not exposed;

- Soft areas shall be avoided within buffer zones and clearing is to be abandoned if any rutting should occur;

- There will be no skidding of trees across a watercourse;

- It may be necessary for the contractor to use floatation tires on his vehicles, properly sized for the vehicles so that the ground surface is not broken;

- Before any merchantable timber or non-salvageable material is removed from the buffer zone, the ground must be sufficiently frozen so that machinery does not break the surface and expose the underlying soil;

- Brush matting may be left in the buffer zone on site specific basis with the approval of DFO and DEL;

- All clearing related activities near watercourses will be undertaken in a manner which will avoid erosion and sedimentation both during and following the work; and

- Environmental inspection will occur as soon as possible after the snow melts to evaluate the need for erosion and sedimentation control measures. If required, the Project Engineer will ensure the installation of adequate protection and stabilization measures.

The contractor is hereby advised that the clearing operation can be suspended at any time if environmental concerns warrant.

If there are any watercourses or wetlands of special concern, further mitigation requirements will be specified in the Project EPP and site-specific EPPs for various sections of the highway.

3.2.2 Wildlife and Wildlife Habitat

TPW or its contractors will not disrupt wildlife. Firearms are strictly prohibited in work vehicles and within the ROW.

The ROW crosses wetland habitats. In these areas the work will be undertaken in a manner that minimizes habitat disturbance and does not result in the alteration of wetland hydrology. If the crossing of a wetland is unavoidable, then the measures for crossing watercourses will be utilized.

There is a possibility some species of migratory birds may nest in this area during the winter months. The *Migratory Bird Convention Act* and Regulations apply to this work. If any nesting birds are found, contact TPW immediately. DNR or the Canadian Wildlife Service shall then be contacted.

3.2.3 Heritage Resources

Heritage Resources include sites and artifacts which have archaeological or historic importance or interest. Should artifacts be discovered, all work in the area of discovery will be suspended and the Provincial Archaeologist (902-424-6461) or Curator of Special Places (902-424-6475) will be notified. Work will not continue until permission has been granted.

Prior to starting work, the Contractor shall contact the affected Mi'kmaq community (contact either the Confederation of Mainland Mi'kmaq, Michael Cox, Director of Lands, Environment & Natural Resources at 902-895-6385, or the Union of Nova Scotia Indians, Kim Paul, Environmental Technical Services at 902-539-4107)

3.3 Land Use

Highway ROW's traverse a variety of land uses. The Contractor shall contact landowners of planned work whenever possible, and every effort will be taken to carry out the work in a manner which causes minimum inconvenience to the landowner. Prior to starting any work, the Engineer will familiarize the Contractor with any landowner agreements in order to implement TPW's commitments.

The ROW will be maintained in a clean and neat condition. Litter and construction waste will be removed from the job site and properly disposed of regularly. Whenever possible, a 30 m strip of natural vegetation will be maintained adjacent to residences and roads.

3.4 Special Substances

All necessary precautions to prevent and minimize the spillage, misplacement or loss of fuels and other hazardous materials will be taken. All Acts and Regulations pertaining to special substances will be followed. The delivery, storage, use and disposal of these hazardous materials will be handled only by trained personnel in accordance with government laws and regulations. The following precautions will be taken:

1. Equipment used will be mechanically sound with no oil or gas leaks. Fuelling or servicing of construction or mobile equipment is not allowed within 75m of a watercourse;

2. Storage of petroleum products is not allowed within water supply watershed boundaries. Pits, greases, gasolines, diesel or other fuels will not be stored within 100 m from any surface water supply; and

3. Waste oils and lubricants will be retained in a tank closed container, and disposed of in an environmentally acceptable manner.

In the event of an oil spill, the Contractor will take the following actions to minimize environmental damage and initiate TPW's emergency response program. Further information is provided in Appendix F.

1. Stop further discharge;

2. Contain the spill;

3. Collect/gather up oil and contaminated soil;

4. Notify the Project Engineer of the spill. All spills shall be reported to DEL Environmental Emergencies (1-800-565-1633); and

5. Dispose of materials in an approved manner and in accordance with the appropriate Provincial Acts and Regulations.

The Contractor will not be permitted to construct machinery maintenance depots, refuelling stations, storage yards, or any type of installation, as determined by the Project Engineer, that could possibly cause contamination to streams and lakes through the disposal of human waste, oil, grease or other deleterious material.

Any material contaminated by the accidental spilling of fuel, anti-freeze, oil or grease that, in the judgement of the Project Engineer, may cause contamination to the streams or lakes, shall be loaded and transported to an area where it can be disposed of in an approved manner.

NOVA SCOTIA

Transportation and Public Works

APPENDIX E

CONSTRUCTION SPECIFICATIONS FOR ACCESS ROADS
(January 2005)

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2.0 CONSTRUCTION SPECIFICATIONS FOR ACCESS ROADS 1

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4.0 CONSTRUCTION PRACTICES 2
- 4.1 Clearing 2
- 4.2 Grubbing 3
- 4.2 Construction of Subgrade 4
- 4.3 Construction in Swamps 6
- 4.4 Graveling 7
- 4.5 Drainage Ditches and Culverts 7

5.0 ROAD MAINTENANCE 9

6.0 ROAD ABANDONMENT 9

1.0 INTRODUCTION

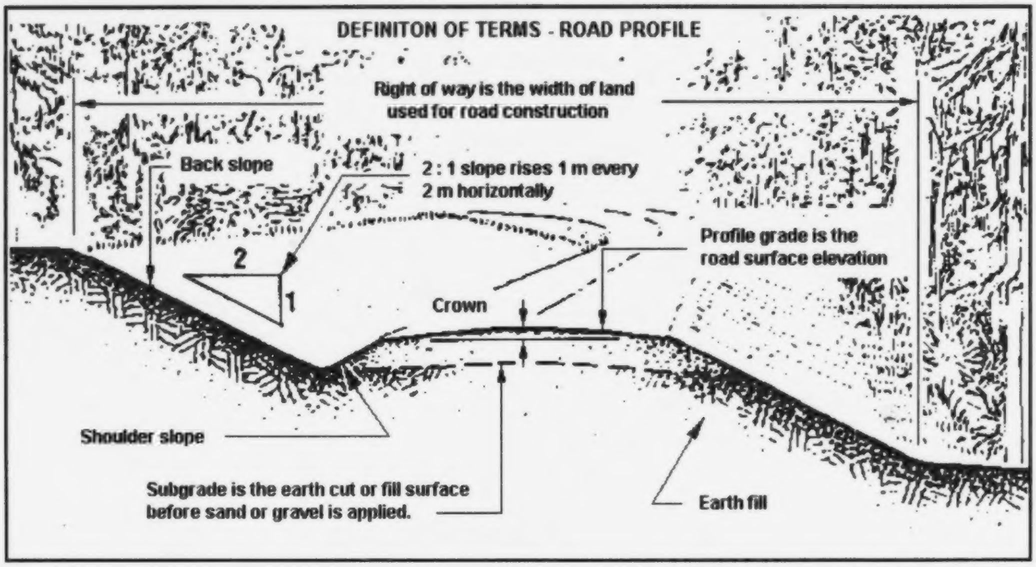
Good practice guidelines are provided for each component of planning, constructing, maintaining and abandoning access roads and water crossings - flexibility is expected in their application, however they should be followed to the extent reasonably possible through the entire length. Approval for water crossings must be received from DFO and DEL prior to any work commencing.

2.0 CONSTRUCTION SPECIFICATIONS FOR ACCESS ROADS

Specifications:

1.	ROW width.....................	20 m
2.	Grubbing width...............	varies
3.	Grubbing depth...............	15-30 cm.
4.	Subgrade width (top)......	6.8 m
5.	Subgrade depth..............	grade as per profile drawings.
	- approx. 50 cm above ditch.	
	- approx. 30 cm above 300-1000 mm culvert.	
	- approx. 50 cm above 1100-1900 mm culvert.	
	- approx. 60 cm above 2000 mm culvert	
	- approx. 60 cm above top of swamp.	
6.	Finished top width (gravel)	6.0 m
7.	Gravel Thickness........	200 mm
8.	Type of Gravel............	Type II (125 mm) and Type I (75 mm)
9.	Grading	
	Tangents.....................	15 cm crown.
	Curves.........................	Superelevated (0.020 m/m max.)

DEFINITON OF TERMS - ROAD PROFILE


Right of way is the width of land used for road construction
Back slope
2 : 1 slope rises 1 m every 2 m horizontally
2
1
Profile grade is the road surface elevation
Crown
Shoulder slope
Subgrade is the earth cut or fill surface before sand or gravel is applied.
Earth fill

3.0 PLANNING AND LOCATION

The location of a particular access road has an important influence on the impact the road will have on the natural environment. The following are good planning processes:

- Ensure areas of concern such as canoe routes, erosion control, aesthetics, osprey nests, etc. are protected.
- Avoid hilly terrain (*i.e.* steep grades; 10% or more), deep swamps, bedrock, erodible soils and shallow soil areas.
- Road alignments should follow the contours of the land as much as possible.
- Gentle grades (1-4%) are desirable for proper drainage and economical construction.
- Long, sustained grades should be avoided since they allow excessive run-off build up in ditches that can lead to erosion.
- Buffer zones of undisturbed vegetation between the access roads and water bodies should be maintained and should increase in width proportionally to the increase in slope of land entering the waterway.
- Minimize the number of water crossings.
- The preferred crossing method in streams which are used for fish migration or contain spawning habitat is a method that will not disturb the stream bottom such as a bridge or arch culvert.
- Openings shall be sized to minimize the risk of culvert or bridge washout during the life of the structure.
- Culverts with slopes greater than 0.5% may require baffles to permit fish passage. Bridges or arch culverts are an acceptable alternative.

4.0 CONSTRUCTION PRACTICES

4.1 Clearing

Clearing consists of cutting trees within the designated right-of-way. The following are good construction practices:

- Do not clear an area larger than necessary.
- Reduce clearing width to the minimum needed for construction within the designated buffer zone of a watercourse or water body identified by the regulatory agencies as being sensitive.
- Away from water crossings, a minimal width of 20 m should be cleared to ensure the road will dry out, and provide sight lines for safety..
- If possible access roads should be cleared during winter months to reduce rutting.

The cut-off height of trees shall be 300 mm (or less) above the ground level unless otherwise approved. Clearing shall not be carried out where shrub is less than 1.5 m in height.

Following approved disposal of merchantable timber, the remaining non-salvageable material such as standing trees, brush, slashings, limbs, fallen branches and other surface litter shall be cut and disposed of by chipping.

Trees of mercantile timber shall be cut to a minimum length of 2.5 m and shall be neatly piled on abutting properties off the right-of-way (ROW) unless otherwise approved. Arrangements will be made with the abutting property owners with respect to the cutting and piling of such trees. All timber with a butt diameter greater than 100 mm and with a minimum diameter of 100 mm at a length of 2.5 m shall be considered merchantable timber. **The merchantable timber shall only be piled on level areas with no piles located within the buffer zone of any watercourse or wetland.**

Additional environmental protection measures for clearing activities are provided in TPW's *Environmental Protection Plan for Construction of 100 Series Highways*

4.2 Grubbing

Grubbing consists of the removal and disposal of stumps, roots, brush, small trees, embedded logs and organic overburden. The following are good construction practices:

- Full width grubbing is done where road-building material is expected to come from within the right of way area.
- In deeper fills grubbing is not necessary.
- To ensure that trees on the bush line are not under-cut, a cleared but not grubbed buffer zone should be left along the edge of the ROW.
- Grubbing shall not be piled where it could block drainage courses.
- Swamps should not be grubbed.
- Grubbing should be minimized in areas of fine grained soils. Grubbing in fine grained soils should be avoided during wet weather.

On sections other than wet topsoil, grubbing shall be just deep enough to remove the stumps and the black humus layer, usually about 15 cm in softwood and 30 cm in hardwood.

If wet topsoil is greater than 15 cm deep, the topsoil shall be removed to firm ground. The grubbed width generally will be 2 m wider than the subgrade width and may extend to within 1.5 m of the edge of the ROW in areas of "Borrow Pits." If the Contractor elects to get borrow from within the ROW, grubbing of borrow pits shall only be done by an excavator. Borrow pits will be grubbed no wider than required for the excavation.

The grubbed material is first "parked" before it is placed in the Borrow Pit. The area under the grubbing pile is also grubbed when the material is pushed out into the pit. When dozing grubbed material into the pit, the front section is to be filled and leveled first. If there is not enough material to fill the pit, the front section should at least be filled and the back part may be left open.

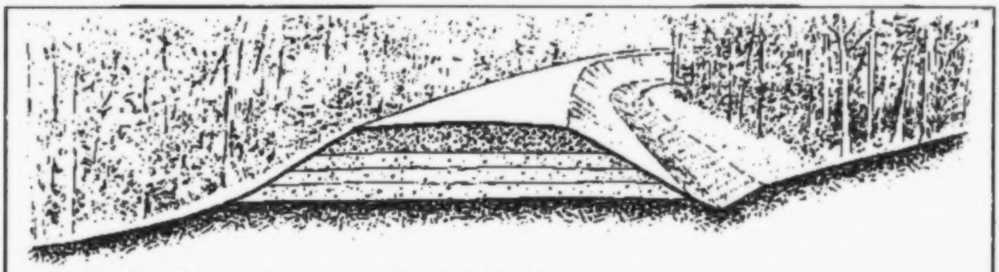
Grubbing is not required under embankments which cover stumps by 0.5 m. **For environmental purposes, grubbing will only be allowed to advance 200 metres in advance of the subgrade construction.**

Additional environmental protection measures for grubbing activities are provided in TPW's *Environmental Protection Plan for Construction of 100 Series Highways*.

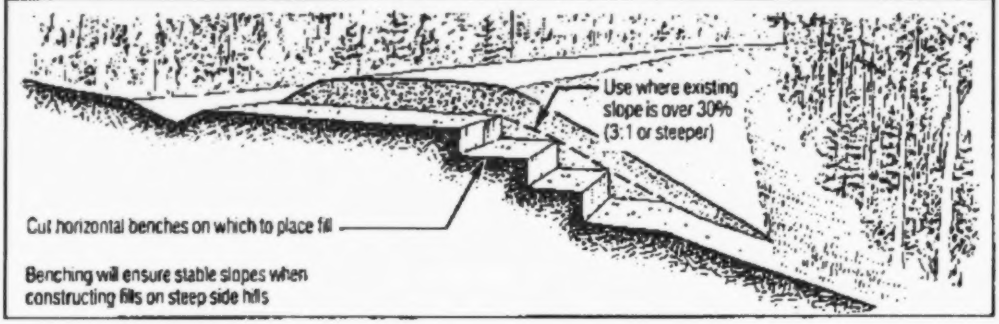
4.3 Construction of Subgrade

The following are good subgrade construction practices:

- In poorly drained areas, backhoes should be used to construct fills by pulling in material from within the ROW. It allows for better material selection and creates less disturbance and gives the fill a chance to dry out and consolidate.
- Retain natural vegetation near water crossings as long as possible, to reduce the time the soil is exposed.
- Do not dump waste material in areas that may block the flow of water.
- Fill in and around water bodies should be constructed with earth-free rock or clean, well graded, granular material.
- Keep earth fills and earth cuts as shallow as possible. A desirable road surface is about 0.6 - 1.0 m above the original ground
- When building fills on side slopes, benching into the original ground will prevent slippage along the interface.



Earth fills constructed in layers with equipment travelling over the full width of each layer will produce dense erosion resistant fills with fewer soft spots


Use where existing slope is over 30% (3:1 or steeper)
Cut horizontal benches on which to place fill

Benching will ensure stable slopes when constructing fills on steep side hills

- The subgrade should be graded and crowned as it is being constructed to shed the water and minimize ponding in ruts.
- When obtaining material by excavation within or adjacent to the ROW; try to drain the low pockets as standing water might create a problem.
- Where ditches leading downhill from rock cuts pass over common material, rip rap should be used at the earth/rock interface to prevent erosion.
- Where bedrock projects out into the roadside ditch, either construct an offtake ditch into the natural vegetation, or install a cross culvert or excavate the rock.

The subgrade shall be constructed to the lines and grades as set by the Project Engineer. Material used to construct the subgrade can be obtained from the "Borrow Pits" within the 20 m right-of-way at depths up to 3 m below the ground level. If not, borrow will have to be obtained outside the 20 m ROW. If the Contractor elects to select his Borrow outside the ROW then the source of Borrow shall meet the approval of the Project Engineer and shall adhere to the Pit and Quarry Regulations in effect at the time of the award of the contract.

If the access road crosses a sharp knoll or ridge, the top shall be grubbed off and pushed into low areas of the roadway at the foot of the slope, provided it is covered with 0.5 m of good material. Large stumps shall be removed or turned over and used in the fill.

In the case of sidehills the grubbed material shall be placed under the lower side of the fill and the subgrade constructed from material cut from the up-hill ditch and backslope. Sidehill embankments shall be constructed by dumping successive loads in uniformly distributed layers until the embankment is wide enough to permit the use of compacting equipment.

Compaction shall be done before rain penetrates the fill. Embankment material placed below 300 mm from the top of subgrade shall be compacted to 95% Proctor Density. All embankment material and material within the top 300 mm depth of the subgrade shall be compacted to 98% Proctor Density.

If the material is too wet for compaction it shall be left to become sufficiently dry before being compacted.

The following environmental protection measures apply to subgrade construction:

- For environmental purposes, once work on the construction of subgrade begins, the subgrade shall be completed in 200 m sections. Subgrade shall be built to final grade, slopes dressed and hydroseeded and covered in straw/hay mulch before subgrade construction on the next 200 m is allowed to commence. In the case where the Contractor elects to get borrow from within the ROW, then the construction of subgrade will mean to include all borrow pits within the ROW.

- All exposed slopes shall be covered with straw/hay mulch at a rate of approximately 25 m^2 per bale. For the purpose of this specification, the size of a bale is considered to have approximate dimensions of 0.3 m x 0.45 m x 1.0 m and an approximate mass of 20 kg.

- Prior to the placement of the straw/hay mulch all exposed areas shall have lime, fertilizer and seed placed.

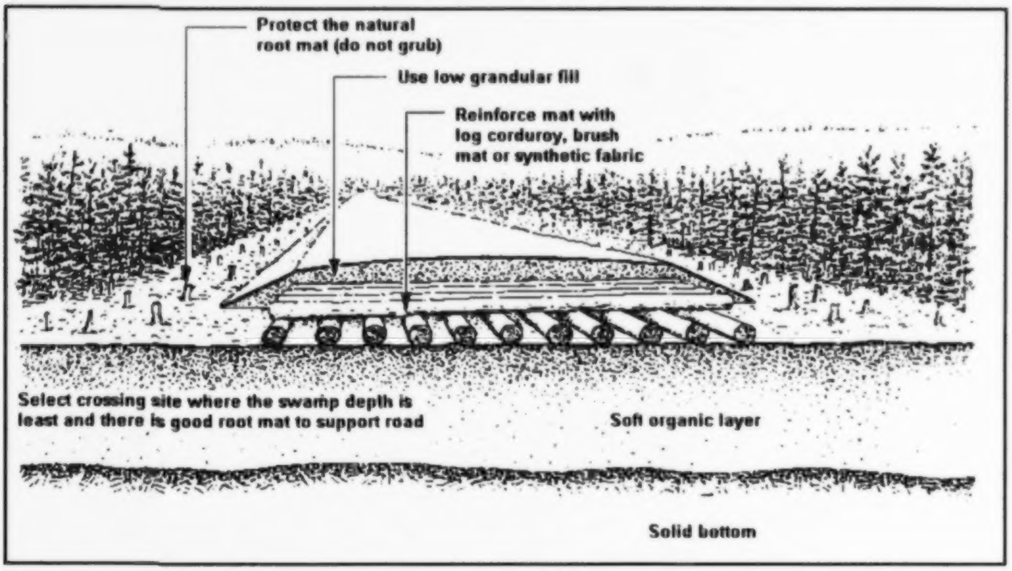
- The lime shall be spread at a rate of 2200 kg/ha and 15-25-15 fertilizer at a rate of 625 kg/ha. The seed shall be a mixture of 40% Creeping Red Fescue, 15% Timothy, 15% Tall Fescue, 10% Kentucky Blue Grass, 10% Alsike Clover, 5% Red Top, 5% Perennial Rye, at a rate of 100 kg/ha. For seeding after September 1, the fertilizer shall be 10-20-20.

Further details on stabilization is provided in TPW's *Environmental Protection Plan for the Construction of 100 Series Highways.*

4.4 Construction in Swamps

Good construction practices involving swamp treatments include:

- Deep swamps should be avoided.
- Select a crossing location where there is a well developed root mat supporting tree growth.
- Construction through a swamp area is preferable during the winter; heavier equipment can cross without being bogged down or disturbing the root mat; and, construction can proceed beyond the swamp without having to wait for the completion of treatment.


Protect the natural root mat (do not grub)
Use low grandular fill
Reinforce mat with log corduroy, brush mat or synthetic fabric
Select crossing site where the swamp depth is least and there is good root mat to support road
Soft organic layer
Solid bottom

- The most common swamp treatment involves floating the material on the natural root mat.
- If possible, limit fill depths over swamps to 1.3 metres.
- If the placement of fill on the natural mat is not practical, use reinforcing materials such as geotextiles or log corduroy. If a geotextile is required it shall be non woven and shall be applied at the Manufacturer's Specifications. Seam strength shall be a minimum of 90% of the grab tensile strength of the geotextile and the geotextile shall meet the following average roll values:

Grab Tensile Strength	N	1100
Mullen Burst	kPa	3000
Filtration Opening Size	µm	70-200
Hydraulic Conductivity	cm/s	0.1

- Before placement of the geotextile over the swamp, the area to be covered must be cleaned of all rocks, sticks, branches or other objects that could cause a break in the textile when a load is placed on it. The area under the textile is not to be grubbed. All joints in the geotextile shall be overlapped as per the Manufacturer's Specifications. Equipment of any type must not be permitted to travel over the placed geotextile. Fill material shall be end dumped and spread out over the geotextile by machine. Fill used on swamp crossings, where the road is floated on the natural mat, should be free of large boulders or rocks that can puncture the mat.

- Enough culverts should be provided to ensure that the surface water is equalized on both sides of the road. The culvert(s) should be located where the organic deposit thickness is the least (less settlement).

4.5 Graveling

The subgrade shall be shaped, compacted and crowned before the placement of the gravel layer. This will allow subgrade to shed water seeping through porous gravel during wet periods. Gravel Type II shall be applied at a thickness of 125 mm; then covered with Gravel Type I to a thickness of 75 mm. For environmental purposes, as each 200 m section of roadway is completed then Gravel Type II must be applied within 72 hours of completion of subgrade.

4.6 Drainage Ditches and Culverts

The following are good construction practices:

- It is important to differentiate between cross drain culverts and instream culverts. Cross drain culverts are those required to pass local surface flows channelized by the road construction. There is no defined channel prior to construction and there are no fish in these channels. Instream culverts are those required where the road crosses a natural watercourse that has a defined channel.
- All culverts shall be installed in a manner which minimizes sedimentation as the down steam receiving water will eventually be fish bearing.
- Installation should be done in the driest possible time of the year (*i.e.*, June 1 to September 30).
- The ground vegetation should not be disturbed within 30 m of any stream crossing until after all environmental controls associated with the crossing are installed.
- Whenever possible instream culverts shall be placed on the natural stream gradient which should not exceed 1%. At any location where fish may be present and the slope of the culvert exceeds 1% fish passage facilities will be required.
- The bottom of the instream culverts shall be between 150 mm and 300 mm below the stream bed.
- If more than one culvert is set side by side, only one culvert needs to be set below the stream bottom.
- Where cross drain culverts are used on down grades to divert flow and minimize ditch erosion, they should be angled across the road.
- The minimum size of culverts used on roads needed for 10 years should be 500 mm in diameter.
- Rip Rap should be placed on the upstream fill slope of the culvert inlet, to the top of pipe to prevent scour during high flow periods. Rip Rap protection should be provided downstream of culvert if high flow velocities are expected to act as an energy dissipator.

Culvert Size	Length of Rip Rap Protection
> 600 mm	1.0 m
< 600 mm	1.5 m

The minimum rip rap wall thickness shall be 400 mm.

- For in-stream culverts, the following two conditions must be satisfied prior to commencement of culvert installations.

    1. A buffer zone of 30 m or greater shall be maintained on both sides of the water course within which no grubbing or infilling is to take place until the culvert and erosion control devices are installed.

    2. C2 Gravel (100-150 mm Clear Stone) and C1 Gravel (5-20 mm Clear Stone) shall be placed at the proposed ends of the culvert before any excavation is allowed.

- The in-stream bottom and banks at the outlet of all instream culverts shall be protected from scour from water leaving the culvert. Special Gravel 150 mm in size shall be placed at the downstream end of the culvert at the distances indicated below.

Culvert Size	Length of Rock Protection	Thickness
500 mm	2 m	300 mm
600 mm	2.7 m	300 mm
750 mm	3.3 m	300 mm
900 mm	4.0 m	300 mm
1200 mm	5.5 m	450 mm
1500 mm	7.0 m	450 mm
1800 mm	10.0 m	450 mm

- Water Control for in-stream culverts will be carried out using one of the following methods:
    1. For structures that span most or all of the streambed, install sheetpile barriers or cofferdams, pump the water to an adjacent vegetated area or settling pond, and complete the footings and culvert installation in the dry (Note: rescue any trapped fish by netting or electrofishing as per DFO requirements)
    2. Dam the stream and pump the flow around the site (ensure continuous monitoring to maintain flow to downstream areas).
    3. Divert the flow around the site in a stabilized channel until the new culvert is completely installed.
    4. Build the new culvert in the dry and divert the stream into it upon completion.

- Ditches should be constructed uphill, to avoid trapping of water. All roadside ditches should flow to an outlet downstream of the ROW.
- Cross culverts and offtake ditches are required to ensure adequate roadside drainage. The recommended spacing of these depend on ground soil type, as indicated in the following table.

Ground Slope	Erodible Silt - Clay	Normal Soils Loam	Rock Soil, Sand and Gravel
Gentle, Under 5%	300 m	600 m	No Limit
Moderate, 5-10%	150 m	300 m	600 mm
Steep, Over 10%	100 m	150 m	300 mm

- Off-take ditches shall divert flow into the bush so the water filters through natural vegetation before entering the watercourse. Off-take ditches are to be constructed 30 metres back from any watercourse.
- Interceptor ditches may be necessary to divert water away from steep cuts or fill slopes.
- Long roadside ditches on slopes over 2% (two percent) may require check dams, intermediate cross culverts or off-take ditches to reduce flow velocity and water quantity if erosion is a problem.
- To ensure that drainage ditches are not blocked, side roads should have entrance culverts installed.

In some contracts, bridges may be required for sensitive watercourse crossings. In these cases, a site- or project-specific EPP will be prepared to summarize the design and environmental protection measures.

Further details on environmental protection measures for culvert installations are provided in TPW's *Environmental Protection Plan for the Construction of 100 Series Highways.*

5.0 ROAD MAINTENANCE

Road Maintenance can be broken down into two main groups: routine and non-routine. Routine include day-to-day activities to maintain traffic using it (grading, snow plowing, maintenance of drainage i.e., cleaning blocked culverts and ditches. Non-routine maintenance includes major repairs and restoration. These roads may require major maintenance or reconstruction every 10 - 20 years (Brush control, replacement of gravels, repair of flood damage, replacement of sub-standard bridges). If a road is not maintained it should be abandoned.

Maintenance shall include:

- Regular inspection of drainage structures and ditches and upkeep if necessary.
- Loose gravels shall be graded back to the center of road to prevent creation of berms that could channelize water down road and erode the fill slopes.
- Grading of road surface to minimize rutting.
- Management or removal of nuisance beaver.
- Heavy equipment (should not be allowed on roads during spring break up).
- Snow banks shall be winged back to minimize spring saturation and erosion of roadbed.
- Roadside vegetation that prevents drying of road and restricts safe visibility should be removed.
- If a herbicide is used, a 30 m buffer zone should be maintained adjacent to all water bodies.
- Following timber management operations along the roadside, the roadway cross section should be restored by repairing damaged slopes, culverts and ditches.

6.0 ROAD ABANDONMENT

There are two types of abandonment:

Physical Abandonment

This occurs when there is a deliberate attempt to render a road unusable by vehicular traffic. Physical steps may be taken to minimize the environmental impacts of non-maintenance.

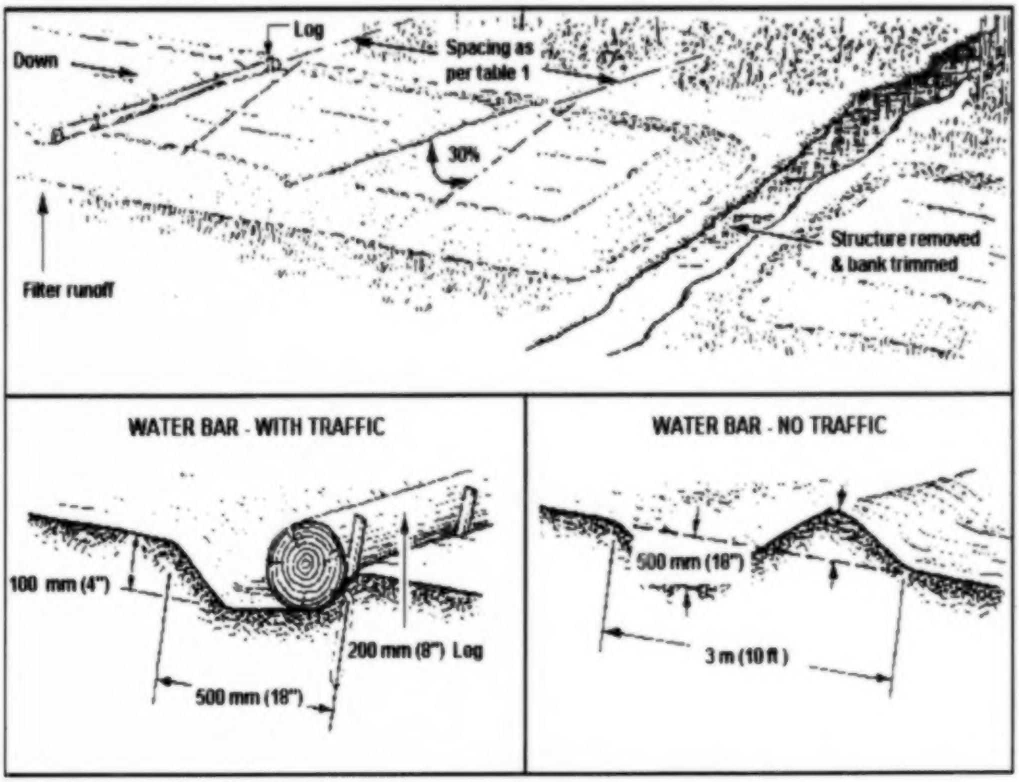
Natural Abandonment
This occurs when road maintenance has ceased, yet steps have not been taken to prevent the use of the road by vehicles. With natural abandonment, no physical changes are made to the road.

In either case, abandonment should be carried out in an environmentally sound manner. When a road is not maintained, frost and runoff will lead to loosening and erosion of fill and road surfaces. In the area of watercourses, water can flow down the road and erode the road surface and underlying fill. Preventative measures can be taken to minimize erosion of the roadfill and subsequent sedimentation of the watercourse.

Water bars can be used to control surface runoff and minimize erosion of the road surface and fill. Water bars are traverse ditches excavated across the road surface to intercept runoff and deflect it towards the ditch instead of flowing along the road surface. The outlet of the water bar shall be extended into an area that is erosion resistant and that will filter out sediment.

There are two types of water bars:

1. One uses a log to divert water while still permitting passage of vehicles over it.
2. The other would be used where there is no traffic on the road.


Log
Down
Spacing as per table 1
30%
Filter runoff
Structure removed & bank trimmed
WATER BAR - WITH TRAFFIC
100 mm (4")
200 mm (8") Log
500 mm (18")
WATER BAR - NO TRAFFIC
500 mm (18")
3 m (10 ft)

Water bars should be spaced closer together in steeply sloping terrain. Water crossing structures that have required on-going maintenance to keep functioning, or which have deteriorated with time and may collapse into a waterway should be removed when the road is abandoned. It is not necessary to excavate stable bridge abutments and erosion protection work. The banks and approaching fills should be graded to a stable angle similar to the adjacent natural river banks and provided with erosion control treatment to prevent erosion. Exposed soil on banks should be seeded and fertilized to speed re-vegetation.

NOVA SCOTIA
Transportation and Public Works

APPENDIX F

SPILL CONTINGENCY PLAN
(January 2005)

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OCCURRENCE REPORT FORM

1. SCOPE

The purpose of this plan is to describe the procedures to be followed in the event of an incident involving the release of a contaminant into the environment. It is intended to satisfy the requirements of the Dangerous Goods Management Regulations of the *Environment Act*, Province of Nova Scotia, as well as Fisheries and Oceans Canada (DFO) approvals and authorizations.

This plan is to be operational at all Transportation and Public Works (TPW) highway construction projects around the province.

Other organizations which have specific responsibilities identified within this plan include:
- NS Department of Environment and Labour (NSEL)
- Local Fire and Police Stations
- Emergency Measures Organization (EMO)
- Canadian Coast Guard

Note that all spills, regardless of their size, must be reported to the 24-hour Emergencies Reporting System (1-800-565-1633).

2. TERMS - DEFINED

TPW Spill Contingency Plan - This Plan, a predetermined communications and action sequence which can be initiated immediately to cope with an event of potential but uncertain occurrence.

Occurrence - Release of deleterious substances into the environment. Includes materials regulated or controlled under the *Environment Act*.

Countermeasures Phase - The time period beginning at the time of the occurrence and ending upon completion of all required procedures, including the filing of a report detailing the response, if necessary.

Response Team Leader - The person in charge of the countermeasures phase. For highway construction projects, this will typically be the Project Engineer.

First Responder - The person who first responds to the occurrence.

Contaminant - A substance that causes or may cause an adverse effect on the environment.

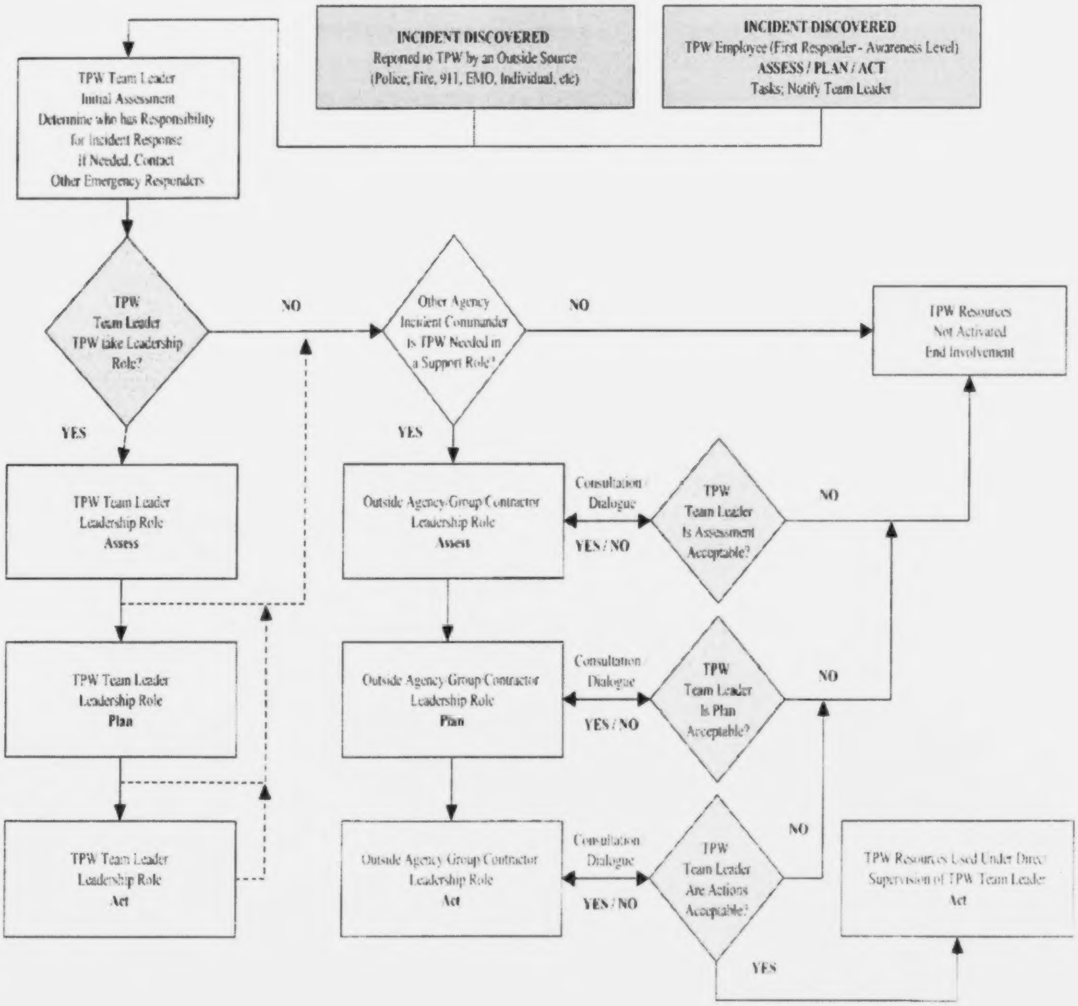
Major Spill - Spills in excess of the amount indicated in Schedule "A" (see section 6), Column 4.

Minor Spill - Spills less than the amount indicated in Schedule "A" (see section 6), Column 4.

The reader can obtain further planning information in the Canadian Standards Association (CSA) publication, *Emergency Planning for Industry*, CAN/CSA-Z731-95.

3. NOTIFICATION PROCEDURES (24 Hours Per Day)

Department of Transportation and Public Works - Emergency Response Program Flow Chart


INCIDENT DISCOVERED
Reported to TPW by an Outside Source
(Police, Fire, 911, EMO, Individual, etc)
INCIDENT DISCOVERED
TPW Employee (First Responder - Awareness Level)
ASSESS / PLAN / ACT
Tasks; Notify Team Leader
TPW Team Leader
Initial Assessment
Determine who has Responsibility
for Incident Response
If Needed, Contact
Other Emergency Responders
TPW
Team Leader
TPW take Leadership
Role?
NO
Other Agency
Incident Commander
Is TPW Needed in
a Support Role?
NO
TPW Resources
Not Activated
End Involvement
YES
YES
TPW Team Leader
Leadership Role
Assess
Outside Agency/Group/Contractor
Leadership Role
Assess
Consultation
Dialogue
YES / NO
TPW
Team Leader
Is Assessment
Acceptable?
NO
TPW Team Leader
Leadership Role
Plan
Outside Agency/Group/Contractor
Leadership Role
Plan
Consultation
Dialogue
YES / NO
TPW
Team Leader
Is Plan
Acceptable?
NO
TPW Team Leader
Leadership Role
Act
Outside Agency/Group/Contractor
Leadership Role
Act
Consultation
Dialogue
YES / NO
TPW
Team Leader
Are Actions
Acceptable?
NO
YES
TPW Resources Used Under Direct
Supervision of TPW Team Leader
Act

4. NOTIFICATION LIST

Field Office: ____

Civic Address: ____

Project Engineer: ____________________ **Phone (h)**________ **(c)**________

Designated Team Leader: ____________________ **Phone (h)**________ **(c)**________

Fire: ____

Police:____

Ambulance: ____

Environmental Emergencies Reporting Centre: 1-800-565-1633 or 1-902-426-6030

Local Department of Environment and Labour contact: ____________________

Phone (h)________ **(c)**________

CANUTEC (for product information) **613-996-4624**

Contractors who can assist in clean-up:

____

____

____

Contractors who can supply response material:

____

____

____

____

TPW Contacts (Halifax):

Manager, Environmental Services Section:	**424-4725**	**Cell: 471-2396**
Director, Public Affairs and Communications:	**424-3289**	**Cell: 456-4212**

Additional Contacts:

____

____

5. ROLE OF RESPONSE TEAM LEADER

The Response Team Leader is the person in charge of the countermeasures phase of any clean-up, and must perform or ensure the performance of the following:

- Take charge from the First Responder.
- Make decisions.
- Commit resources.
- Communicate with personnel representing other agencies (see Notification List, above).
- Direct the use of needed resources.
- Act as the focal point for information exchange.
- Ensure that samples are collected.
- Prepare and submit a report detailing the response when necessary (see Section 10).

The following information should be completed by the Project Engineer to designate another person as the Response Team Leader for a spill clean-up.

Event:

____

(Provide the event/spill name and estimates of the spill volume and area)

____

(Provide the name of the First Responder and details about the spill location and the discovery date and time)

____

______________________________ is the Response Team Leader for this event.
(Fill in name and phone number)

As Team Leader, ____________________ has the responsibility and authority to carry out
(Team Leader's name)
the above duties.

Signed,

____
(Project Engineer)

6. CONTAINMENT AND CLEAN-UP PROCEDURES

6.1 Non-transport Related Releases

Please refer to the following table, Schedule "A", reproduced from the Emergency Spill Regulations of the *Environment Act*, for information on possible contaminants and spill limits (before reporting to the local NSEL office is required). If a contaminant is spilled in greater quantity than what is identified in Column 4, the Response Team Leader is required to notify the local NSEL contact (see Notification List) in addition to the Environmental Emergencies Reporting Centre (1-800-565-1633 or 1-902-426-6030) and TPW's Environmental Services Section. Note that NSEL should only be called if the spill is released to the environment (spills within a building on a concrete floor are not reportable to NSEL).

For detailed information on emergency response for materials, refer to the "North American Emergency Response Guidebook."

Schedule "A"
Spill Report Requirements

Column 1	Column 2	Column 3	Column 4
Item No.	**TDGA Class**	**Description of Contaminant**	**Amount Spilled**
1	1	Explosives	any amount
2	2.1	Compressed gas (flammable)	100 L
3	2.2	Compressed gas (non-corrosive, non-flammable	100 L
4	2.3	Compressed gas (toxic)	any amount
5	2.4	Compressed gas (corrosive)	any amount
6	3	Flammable liquids	100 L
7	4.1	Flammable solids	25 kg
8	4.2	Spontaneously combustible solids	25 kg
9	4.3	Water reactant solids	25 kg
10	5.1	Oxidizing substances	50 L or 50 kg

Column 1	Column 2	Column 3	Column 4
Item No.	**TDGA Class**	**Description of Contaminant**	**Amount Spilled**
11	5.2	Organic peroxides	1 L or 1 kg
12	6.1	Poisonous substances	5 L or 5 kg
13	6.2	Infectious substances	any amount
14	7	Radioactive substances	any amount
15	8	Corrosive substances	5 l or 5 kg
16	9.1 (in part)	Miscellaneous products or substances, excluding PCB mixtures	50 L or 50 kg
17	9.1 (in part)	PCB mixtures of 50 or more parts per million	0.5 L or .5 kg
18	9.2	Environmentally hazardous substances	1 L or 1 kg
19	9.3	Dangerous wastes	5 L or 5 kg
20	none	asbestos waste defined in Asbestos Waste Management Regulations	50 kg
21	none	Used oil as defined in the Used Oil Regulations	100 L
22	none	Contaminated used oil as defined in the Used Oil Regulations	5 L
23	none	A pesticide in concentrated form	5 l or 5 kg
24	none	A pesticide in diluted form	70 L
25	none	Unauthorized sewage discharge in fresh water or sensitive marine water	100 L
26	none	Ozone depleting substances as defined in the Ozone Layer Protection Regulations	25 kg

6.2 Transport Related Releases

In addition to the information contained in Section 6.1, the following section of the *Transportation and Dangerous Goods Act*, 1992, shall be adhered to with respect to the release of dangerous goods while transporting them (*from Section 7, "Emergency Response Assistance Plans"*):

> 7.(1) Before offering for transport or importing any quantity or concentration of dangerous goods prescribed for the purposes of this section, **a person shall have an emergency response assistance plan** that is approved under this section and outlines what is to be done if there is an accident in transporting the dangerous goods.

7. RESTORATION

The goal of restoration is to restore the site so that it can be safely used for the same purposes as it was prior to the occurrence. Restoration may involve such things as replacing contaminated soil with clean fill or routing watercourses away from the contaminated site until it can be cleaned up. NSEL may place more stringent requirements for site restoration depending on the circumstances which exist at the time of site restoration.

Contact your local NSEL office for their comments and/or TPW's Environmental Service Section (424-4080 or 424-4725) for more specific information on restoration at your site.

8. DISPOSAL

Disposal procedures are identified within the contaminant specific plans, attached to this plan.

9. COMMUNICATIONS

As noted above, the First Responder should immediately contact the Project Engineer (PE). The PE will then assume the role of Response Team Leader, or designate someone else, and in turn notify (1) the Environmental Emergencies Reporting Centre at 1-800-565-1633 or 1-902-426-6030 and (2) TPW Environmental Services Section at 424-4080/4725 (or the Manager's cell phone 471-2396 [Chris Moir]). If spilled quantities exceed limits noted in "Schedule A" above, the local NSEL contact shall also be notified.

For major spills or spills to sensitive areas, Linda Laffin, Director, Public Affairs and Communications (Tel: 424-3289; Cell: 483-0574), may be directed to prepare an appropriate media release. This action will require the completion of key portions of an "Occurrence Report Form" (*see template at the end of this document*).

10. REPORTING

NSEL may request a report from responsible parties from TPW depending on the severity of the release and degree of concern which resulted from the release. The Team Leader should use the "Occurrence Report Form" located at the end of this document when reporting the release. Completed copies should be submitted within 24 hours of the discovery to the local NSEL office and to the Manager, TPW Environmental Services Section (copies to be sent by facsimile to 424-7544 and email to moirc@gov.ns.ca).

Under TPW's new Health, Safety and Environment Program (December 2004), the Team Leader should also complete either HSE Form 8.1 (Incident Report/Investigation) or HSE Form 8.2 (Minor Incident Reporting Log) depending upon the size of the spill (copies of these forms have been placed in Appendix G). Completed forms should be forwarded to the Manager/JOHSE and the Manager-Environmental Services Section. Further guidance is given in the HSE Program Manual (see Volume 1, Chapter 8: Investigation).

OCCURRENCE REPORT FORM
Department of Transportation and Public Works

This form is to be filled out by the Team Leader and submitted to the Nova Scotia Department of Environment and Labour (NSEL) within 24 hours of the occurrence. A copy is also to be sent to the Manager, TPW Environmental Services Section.

1. Date of release: ____________________
2. Time of release: ____________________
3. Weather conditions at the time of release and during the response phase: ____________________
4. Cause of the release: ____________________
5. Product(s) and quantities involved:

Product	**Quantity**

6. Area and/or property impacted: ____________________

7. Identify all parties and individuals involved in the response or exposed to the product or its vapours, including by-products of combustion (use separate page if more space is required):

Name	***Position and Phone Number***

8. Was there any health treatments or tests conducted on individuals named above?

Yes ______________ No ____

If yes, who received these tests and what kinds of tests did they have?

9. What containment methods were used?

10. What clean-up techniques were used?

11. What were the disposal methods (include quantities and location) were used?

12. Has the site remediation been _______ planned ? _______ completed?

Detail the present status of the site. ____________________________

13. What are the short and/or long term impacts of this occurrence?

14. What measures are to be implemented to prevent any reoccurrence of this kind of incident?

15. Please attach a log of actions taken during this incident including associated times. Note any photographs or samples collected (plus sample handling procedures).

Signature, Team Leader

INCIDENT REPORT/INVESTIGATION

To report an incident:	**Complete sections 1, 2 and 3 (first and second page).**	**Local Report No:**	
For an investigation:	**Complete the rest of the form.** **(Attach additional sheets as required)**	**HR Report No.:**	

SECTION - 1 (Employee Information)

Employee Name:				**Occupation at time of Incident:**	
Mailing Address:				**Experience at incident related job** (months):	
Town/City:					
Province:		**Postal Code:**			
Home Phone:		**Other Phone:**			

Employee Category:	**Permanent:** ☐	**CUPE Regular:** ☐
	Term: ☐	**CUPE Casual:** ☐
Gender:	**Female:** ☐	**Male:** ☐

Was the Supervisor Notified?	**Yes** ☐	**No** ☐	**Supervisors Name:**	
When was the Supervisor Notified?			**Managers Name:**	

Incident Date (D/M/Y):	
Time of Incident (24 hour clock):	
Location of Incident (Include road name, community, county, etc.):	

DIVISION	
Highway Operations ➤ ➤	**Eastern** ☐
Government Services ☐	**Northern** ☐
Public Works ☐	**Central** ☐
Industrial Properties ☐	**Western** ☐
Head Office:DM/FS/HR/IT/P&P/PAC ☐	**Miller Lake/Ferries** ☐
Other (Specify): ☐	**Provincial Outfits** ☐

SECTION 2 (Occurrence)

Indicate the general type of incident in the boxes below. (Check off as many as needed)

Occupational Injury: ☐	**Occupational Illness:** ☐	**Dept. Property Damage:** ☐	**Third Party Damage:** ☐	**Near Miss:** ☐
Environmental Occurrence: ☐	**DEL Reportable Occurrence?**	**Yes** ☐	**No** ☐	**Other** (Specify):

Severity of Injury (Check off as many as needed)			
No Injury: ☐	**First-aid:** ☐	**Medical Attention:** ☐	
Lost Time: ☐	**Fatality:** ☐	**Other Persons Injured:** ☐	
Environmental Impact	**Low** ☐	**Med** ☐	**High** ☐

Did the incident cause the employee to leave work?	**Yes** ☐	**No** ☐
WCB Accident Report filled out?	**Yes** ☐	**No** ☐

DEL LABOUR (1-800-952-2687)

DEL ENVIRONMENT (1-800-565-1633)

Briefly describe how the incident happened:	

Form HSE- 8.1(Rev 20040901)

SECTION 3 (Summary of Factors)	**Local Report No.:**

3(a) Most Serious Injury

Pain: ☐	**Fracture:** ☐	**Swelling:** ☐	**Unconscious:** ☐	**Amputation:** ☐	**Cut/Puncture:** ☐
Burn: ☐	**Bruise:** ☐	**Sprain/Strain:** ☐	**Exhaustion:** ☐	**Dislocation:** ☐	**Abrasion:** ☐

Other (specify):

Body Part Affected (Check off as many as needed) L = Left R = Right B = Both

Head ☐	**Face** ☐	**Neck** ☐	**Chest** ☐	**Back** ☐	**Abdomen** ☐	**Groin** ☐	**Finger or Toe** ☐

Eye	**Ear**	**Shoulder**	**Arm**	**Elbow**	**Wrist**	**Hand**	**Hip**	**Leg**	**Knee**	**Ankle**	**Foot**
L ☐	**L** ☐	**L** ☐	**L** ☐	**L** ☐	**L** ☐	**L** ☐	**L** ☐	**L** ☐	**L** ☐	**L** ☐	**L** ☐
R ☐	**R** ☐	**R** ☐	**R** ☐	**R** ☐	**R** ☐	**R** ☐	**R** ☐	**R** ☐	**R** ☐	**R** ☐	**R** ☐
B ☐	**B** ☐	**B** ☐	**B** ☐	**B** ☐	**B** ☐	**B** ☐	**B** ☐	**B** ☐	**B** ☐	**B** ☐	**B** ☐

Cause of Injury (Check off as many as needed):

Slip ☐	**Trip** ☐	**Fall** ☐	**Lifting** ☐	**Overexertion** ☐	**Pressurized Substance** ☐	
Fire ☐	**Explosion** ☐	**Chemical** ☐	**Inhalation** ☐	**Ingestion** ☐	**Noise** ☐	**Caught Between** ☐
Frostbite ☐	**Cold Stress** ☐	**Heat Stress** ☐	**Electric Contact** ☐	**Struck Object** ☐	**Struck by Object** ☐	
Other (specify):						

3(b) Environment

Aspect:	**Emission to Air** ☐	**Release to Water** ☐	**Contamination of Land** ☐	**Other** (specify):	
What product was released? (specify)					

Quantity			**Who was contacted?**	
Less than 10 litres ☐	**10 to 100 litres** ☐	**100 to 1,000 litres** ☐	**Dept. of Environment:** ☐	**Emergency Measures:** ☐
1,000 to 10,000 litres ☐	**More than 10,000 litres** ☐		**Dept. of Fisheries:** ☐	**No Contact Made:** ☐
Other (specify): ☐		**Contact with :**	**@**	**Date**

Was the NSTP Environmental Contingency Plan implemented?	**Yes** ☐	**No** ☐	**Was the NSTPW Emergency Response Plan Implemented?**	**Yes** ☐	**No** ☐

3(c) Department Property Involved

Vehicle: ☐	**Unit #**	**Seat Belt Used?**	**Yes** ☐	**No** ☐	**TPW Vehicle Speed**	**Km/hr** (approx)
Shop Equipment: ☐	**Specify**		**Power Tools:** ☐	**Specify:**	________	
Building: ☐	**Location:**	________	**Hand Tools:** ☐	**Specify:**		

3(d) Weather Conditions (Check as many as needed):

Sun		**Cloud**		**Wind**		**Rain**		**Fog**		**Snow**		**Freezing Rain**		**Ice**	
Other (specify):								**Approximate Temperature** (Celsius):							

3(e) Other Factors (Check off as many as is needed):

Equipment ☐	**Tools** ☐	**Guards** ☐	**Safety Devices** ☐	**No Lockout** ☐	**Congestion** ☐
Housekeeping ☐	**Terrain** ☐	**Atmosphere** ☐	**Ventilation** ☐	**Body Position** ☐	**Fatigue** ☐
Attention ☐	**Complacency** ☐	**Boredom** ☐	**Frustration** ☐	**Rushing** ☐	**Use of Equipment** ☐
Placement (object) ☐	**Personal Protective Equipment** ☐	**No Authorization** ☐	**Other: Specify**		

SECTION 4 (Investigation)

Local Report No.:

What were the immediate (obvious) cause(s) of the incident? (Examples: slip, trip, fall, etc.)

What were the underlying cause(s) of the incident? (Examples: housekeeping, terrain, condition of footwear, condition of stairways, training, job planning, etc.)

Employee's comments and suggestions:

SECTION 5 (Investigator's Recommendations and Comments)

Answer the question: "How do we prevent this from happening again?" (Attach additional information as required - i.e. photos, sketches, interviews, etc.)

SECTION 6: (Preventative Action)	**Local Report No.:**	

Answer the question: What has or will be done to prevent this from happening again? (Attach additional information as required)

Investigator's Name:		**Investigator's Signature:**		**Date:**	
Investigator's Name:		**Investigator's Signature:**		**Date:**	
Supervisor's Name:		**Supervisor's Signature:**		**Date:**	

Distribution: **Director; Joint Occupational Health, Safety and Environment Committee or Representative;**
Safety and Loss Control Specialist or equivalent, Manager, OHS.

What Follow-up Action is Required?	Action by?(Supervisor/Manager):	Date Completed

Manager's Name:		**Manager's Signature:**		**Date:**	